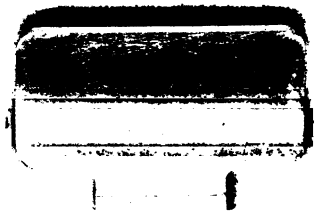
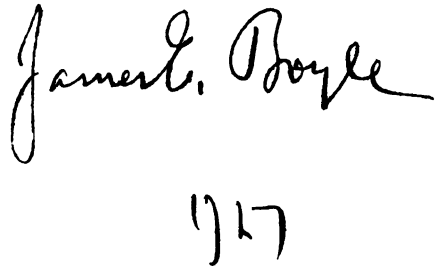



"Silk Worm
Culture."
1882.



AN

INSTRUCTION BOOK

IN THE

ART OF SILK CULTURE,

COMPILED BY THE

Women's Silk Culture Association of the United States,

FROM VARIOUS AUTHORITIES AND ACTUAL EXPERIMENTS, FOR THE USE OF THE WOMEN OF THEIR COUNTRY, WHOM THEY HOPE THEREBY TO AID IN THE PERFECTION OF THIS BEAUTIFUL INDUSTRY IN AMERICA.

NEW AND ENLARGED EDITION.

PHILADELPHIA:
1882.

PREFACE.

IN presenting an instruction book to the public, the Association do not claim to give their own experience in the practical branches of sericulture, not *their* results from such culture. As citizens we have no surroundings to enable us to practically test this agricultural pursuit, but we give such facts as are gleaned from the best books published on this subject, and some of the personal efforts or plans of those who have successfully accomplished Silk Culture. The instructions are explicit and contain all the information which can be given on the subject of Silk Culture to those at a distance, and who cannot attend the school. Facts have been gathered from the best manuals on the subject, and the aim has been to present the simplest and easiest methods of pursuing the work. It is adapted to the needs of a large class of intelligent people all over our land, and commends itself especially to the young, as developing an interest in one of the humblest yet most useful of God's creatures, requiring the intelligent care and observation of the habits of a worm that possesses three strange organizations, whose product forms one of the most valuable commodities of commerce and manufactures, and well may we say part of " a nation's wealth surrounds a worm."

We are indebted to Felix Gillet, of Nevada City, California, an intelligent and experienced silk culturist, for one chapter of excellent matter, also to a work—by the late John Clarke—on the Mulberry tree, permission having been granted to the Association by his daughter, Miss Clarke, of Philadelphia, for the use of extracts from her father's book, as her donation to the women of her country.

Also to Prof. H. C. Kerr, State Geologist of North Carolina, for his valuable illustrated article; to Ira Dinock, President of the Nonotock Silk Company, of Connecticut, for illustrations of reeling; to Lorin Blodget, Esq., for cut of the reel; Werner Istchner, Esq., for his valuable letter, and to several other authorities for the portions of our book relating chiefly to the culture of the silk.

WOMEN'S SILK CULTURE ASSOCIATION.

PHILADELPHIA, *April, 1882.*

INTRODUCTION.

WHEN Providence does anything for man, his business is to coöperate. It has done much for us; has given soils and climates positively omniferous. China herself boasts of nothing superior. We cannot do wrong in stepping on the traces of 4,000 years. Experiments have been made in all parts of the country, and their success has established the fact that *the Mulberry will grow, and the silkworm thrive throughout the whole length and breadth of the United States.*

The process of reeling, also, which was formerly supposed to be of difficult performance, has been so familiarized that children perform it with skill and dexterity. The gathering of the foliage, and the feeding of the worms, may be effected by the children and such other members of the family as are incapable of more arduous labor; one aged person being always in the direction of the business as a responsible head. *If productive labor is a source of wealth, both to nations and individuals, it is desirable that it should be increased to its greatest possible extent. This can only be done by seeking out objects to which the labor of the young, old, and infirm is adapted; and among these, there is none more appropriate than the culture of Silk.*

The importance of this culture and manufacture, both in a pecuniary and moral point of view, is immense. There is probbably no other business in which the same amount of capital will yield an equal amount of income. There can be no better investment. The small amount, too, necessary to a commencement of the business is also an encouragement which no other holds out to the enterprising. *A few acres of*

land of ordinary fertility, and a few dollars in money for the purchase of seeds and plants, will enable a Silk grower to lay the foundation for a plantation on a considerable scale. Another facility peculiar to the business is the ease with which operations are extended, without a corresponding extension of capital. *The ratio in which the Mulberry may be multiplied, by means of cuttings and layers, is astonishing.* Experiments have proved that, with a little labor and attention, *they may be more than* QUADRUPLED *every year.* This will enable the farmer in moderate circumstances to compete with the capitalist, and prevent monopolists from engrossing the whole of the business and its profits. To the individual of limited means, having a large family of children, the culture of Silk holds out encouragement of extraordinary promise; while, at the same time, it affords ample opportunity for the capitalist or the incorporated company to make large investments with the moral certainty of success.

PART I.

REMARKS ON THE CULTIVATION OF THE MULBERRY FOR THE FOOD OF SILKWORMS.

IN offering a few suggestions on the cultivation of the Mulberry tree in its different varities as food for silkworms, we first urge upon agriculturists to plant these thrifty and beautiful trees, as shade and ornamental trees and as hedges around their fields. This latter plan places the culling of leaves within the reach of children and women, and saves labor. In making the decision to do this, we again urge that orders for trees be sent not later than June and July for autumn planting, and in the winter months for spring planting. This enables us to send better trees and to arrange our orders, giving timely opportunity to the nurseryman to select his trees and ship, just at the proper time for planting; which varies in our Northern States from February to April, and from September to December. We are about negotiating with French houses for the importation of trees, until the young nurseries, that will doubtless be planted, shall have time to reach a proper stage for transplanting. Four varieties are recommended: the *Morus Alba* or White Mulberry, the *Morus Elata*, the *Morus Japanica* or Japanese Mulberry, and the *Morus Brossa* or *Morus Tartarean.*

"The first thing to be done towards the production of silk, is a provision of food for the thrifty insect, which will take due care to perform its part, if only we are equally industrious to

perform ours; and its only proper and legitimate aliment is the leaf of the MULBERRY TREE. This tree has been endowed by nature with many properties that render its cultivation, wherever that may be—in the hedge, in the plantation, in the cornfield, or as an ornament around our premises and dwellings—an object happily combining utility, convenience, and pleasure. Independently of the primary purpose of its culture, the production of an agreeable and elegant article of clothing, it leaves the surface less impoverished and incommoded than it is by many other trees, in consequence of its roots striking into the earth not obliquely, but more deeply and perpendicularly." The ground, therefore, between mulberries, or their rows, may, in many cases, be successfully occupied with other products; particularly since neither the shade of the tree, nor the dropping of rain from its leaves, is considered prejudicial to plants growing beneath. It is also a matter of universal observation that no insect except the silkworm will feed on the mulberry leaf. The experiment was purposely tried by M. Pullein, which satisfactorily demonstrated that the product of this tree is the *exclusive property* of the silkworm, or *the insect which apparently works only for man.*

The White Mulberry (*morus alba*) has generally superseded all other kinds in this country for the feeding of silkworms.

They still, however, cultivate the Black (*morus nigra*) in China; and in Spain and Persia it is said that they still prefer that species. The *Morus Alba* (white mulberry) is the species upon the leaves of which the silkworms are now fed; it has sound wood, beautiful leaves and sweet fruit, and is either useful as a forest or ornamental tree. It is also one of the most useful trees in the world, when its importance in connection with Silk Culture is taken into consideration.

There are many varieties of *Morus Alba*, all of which may be utilized for the feeding of silkworms, but the variety called *Multicaulis* is both in France and Italy considered the best.

This variety, however, has been found rather more tender in this country than the other species, and scarcely forms more than a low shrub in the North, and which is often frozen to the ground in severe winters.

Morus Tartarica.

Morus Tartarica, or Tartarian Mulberry, abounds on the borders of the Sea of Azoph, and on the banks of the Volga and of the Don, or Tanaïs. The leaves are large, oval, oblong, serrated and shining. The fruit resembles the *Morus Nigra*. The leaves afford silk of the finest quality. Count Dandolo, in the enumeration of his twelve species, mentions the Morus Constantinopolitana as well as the *Morus Tartarica*. But he nowhere mentions the *Morus Broussa*. This circumstance, and the proximity of Constantinople to Broussa, warrant the presumption, until evidence to the contrary, that these two are the same. It has been asserted that the Broussa can be raised from its own seed; it is, therefore, a species; and whether this species may be considered or not the same as the *Morus Tartarica*, or Tartarian Mulberry, may be more fully determined hereafter.

Moretti Elata.

The *Moretti Elata* does not generate by seed as some other varieties do, but sustains the hardest winters, and is the best adapted for the North. It is fit for standard, forest or ornamental trees. It is straight, with an elegant shape and luxuriant foliage. It is proof against grasshoppers, borers, or any kind of vermin which destroy so many species of trees in this country. It gives one pound of cocoons to every fourteen pounds of leaves.

Morus Japonica.

Morus Japanica or Japanese Mulberry tree—this kind was

introduced into France by Camille Beauvais, and has the largest leaves, giving the same quantity of Silk as the Moretti. It is so easily picked that French breeders prefer to plant it to any other kind. It stands well hard winters, as proved by five years' growth in Kansas, if well cared for.

Morus Alba.

Morus Alba, white or Italian Mulberry, was originally from China, but has been most extensively cultivated in Italy and France for ages. The silk which it produces is of the finest quality. The leaves are cordate, sirrate, entire or lobed. Their upper surface is a shining green, perfectly smooth, and the under has some hairs set on its edges. The flowers are monœcial; some, males, disposed in cylindrical chatons supported on peduncles longer than themselves; the others, females, form round or oval chatons, rather short peduncles, which are succeeded by small berries of the same form, and of a red or white color. The fruit is white, roundish oblong, and *insipid.* It is a tree of rapid growth. In the climate of Paris it attains to the height of twenty-five or thirty feet, but in more southern countries of forty or fifty feet, with a trunk from six to eight feet circumference.*

This tree is known to have attained the venerable age of more than four hundred years. Its superiority over every other mulberry, except the *Morus Multicaulis*, consists in this: it is clothed with leaves fifteen or twenty days earlier than the others; the silkworms therefore, come more speedily at maturity, and are thus preserved from the inconveniences of the hot season. The White Italian Mulberry, moreover, not only

* The bark, according to Rosier, may be converted into linen of the fineness of silk. For this purpose, the young wood is gathered in autumn, during the ascent of the second sap, and immersed for three or four days in water. It is then taken out at sunset, spread on grass, and returned to the water at sunrise, and this is repeated until finally it is prepared and spun like flax.

grows more rapidly, but has a more abundant foliage; and leaves more delicate and nutricious, whence the silk is handsomer and of a better quality.

The White Mulberry (*morus alba*) grows to the height of twenty or thirty feet, is more rapid in growth than the black, and contains more of the glutinous substance resembling caoutchouc, which gives tenacity to silk produced by the worms fed on them, and which is found in all plants on which they exist.

The leaves of the White Mulberry, which produce the best quality of commercial silk, are alternately glossy on the upper side, smooth on both sides, oval, tough, and vary in shape, but are generally heart shaped. The wood of this tree has a good reputation and can be well worked by cabinetmakers, and utilized for fence posts, etc.

Morus Alba Rosea.

Morus Alba Rosea, Rose-leafed Mulberry, is slender, with branches more extended than all the other grafted varieties. It may, however, attain a great height. Its wood is more solid and compact. Its leaves are shining as if varnished, rarely lobed, borne on rose petioles; and its fruit is of a rose-grey, very large, and one pound of cocoons per eighteen of its leaves, produces very fine silk.

Morus Alba Nana.

Morus Alba Nana, Dwarf White Mulberry, is a little larger than that known under the name of Constantinople Mulberry. Its leaves are like those of the *grosse reine*, but its berries are white. It may be advantageously cultivated, since its boughs are near; and this tree of small size will furnish as many leaves as another thrice its magnitude; and a greater number can be planted on the same space of land.

The Morus Multicaulis.

Some remarks on the *Morus Multicaulis* will not be amiss in this little treatise on trees. It has many advantages—from its rapid growth and large leaves, is especially adapted to the South—but will thrive well as far north as the 43d meridian ; indeed the Mulberry grows well wherever the apple tree will grow.

In the South, however, it would probably be the most profitable variety to cultivate. There it would produce leaves more rapidly, consequently more tender and perhaps of a better quality for the worm ; but even there it would require more care in its cultivation.

Where it is possible, it would be well to grow several kinds, so that the superiority of any one over the other may be determined.

Remarks.

The propagation of the Mulberry is very easy by layers and by cuttings ; the latter is the best and most rapid mode of propagation.

Cuttings of the young shoots grown, or even two years' old wood, if taken off in the fall (say November) will root easily the following spring.

The cuttings should be cut evenly across the bottom just below a leaf bud. Shoots one foot in length having three or four eyes or buds planted in the soil, leaving one bud only exposed above ground, will root easily, provided the operation be skillfully done.

In twelve months the young plants will be well rooted and ready for transplanting into nursery rows 2½ x 2½ feet apart each way. This distance allows of their being cultivated each way the same as corn.

If the conditions are favorable they should be trees three or four feet high and large enough for permanent planting the

next season, when they should be planted 6 x 6 feet each way. This will allow 1,210 trees to an acre.

As soon as the branches begin to touch each other, every alternate one should be removed, which will leave the remainder 12 x 12 feet apart, which in time should be further reduced by removing every alternate tree, leaving the remainder 24 x 24 feet apart as permanent trees.

This method of culture allows the trees that are annually removed to be stripped of their foliage without permanent injury, as they are not to be considered as permanent trees. Care should be taken, however, not to strip the foliage of the ones intended for permanent trees before they are sufficiently strong to bear such treatment.

This method is only recommended when a good supply of cuttings are to be had.

In India and China, great silk growing countries, Mulberry trees are planted and cut down twice yearly; this causes them to grow thick and bushy, and facilitates the picking of the trees. It is highly recommended that hedges be planted of Mulberry around the grounds of the farm. This renders picking of leaves easy for children.

In this country, it is admitted as a general rule that all soils adapted to the culture of Indian corn, or that will produce ten bushels to the acre, are adapted to the cultivation of the mulberry.

As to SITUATION or SHELTER, all agree that nurseries and plantations should have a *sunny exposure*, and protection against strong cold winds. *Declivities, hill-sides, land sloping* towards the east, south-east, or south, and protected on the north and north-west by woods, groves, artificial plantations, or buildings, are situations eligible to favor and sustain the growth of the mulberry.

Any land that is suitable for raising a crop of corn will do for cultivating the Mulberry. A dry, warm, sandy loam is

quite congenial to its nature. A cold, damp, or heavy soil, will not answer. It will thrive tolerably well on poor land, but much better on that which is fertile. Prepare the ground as for a crop of corn. and at the same season furrow it into rows 3½ feet asunder. Then scatter well rotted manure in the furrows two inches deep. Trim the trees of every limb, and lay them in the furrows so that they will just reach each other, cover them up about as deep as corn is usually planted, except the roots, which should be buried deeper. Carefully preserve all the limbs and plant them in the same way. Ten trees are often thus procured from one. In about three weeks, should the weather prove favorable, sprouts from the buried tree will break through the ground. After which, the earth about them must be stirred occasionally, and the weeds be kept down till August. Then let them entirely alone that they may ripen, and the wood attain solidity before the coming of the autumn frosts. When the trees have done growing in the fall, pull or plough them up and cut them apart with a knife or pair of pruning shears. To preserve them through the winter, lay them down in the open field on dry ground—cover them with sand and they will be found fresh and in good order the next spring. Or they may be placed in a cellar, with the roots resting on the ground, with some dry earth placed about them.

If your object is to grow more trees, you will, the ensuing spring, again plant according to the directions already given. But if you purpose to make a permanent plantation, you will, after ploughing the ground, set out the trees in rows eight feet apart, and standing two feet from each other in the rows. When Winter again draws near, cut off the trees near the ground, and preserve the trunk and limbs for further increase. When Spring returns the roots and stumps which were left in the ground will send up a great number of shoots, which will put forth a quantity of foliage that will be truly astonishing.

By severing the tree near the earth several advantages are derived. The body and branches are thereby saved to be again planted. The tree is so valuable that this is an important consideration. The quantity of leaves which will grow on the sprouts is greater than could have been obtained from the whole tree had it been left standing. Leaves cannot be gathered from trees of much heighth without reaching or climbing up to them; but they may be plucked from shoots of one year's growth without any such extra exertion, and by children. An early French writer on the subject of the cultivation of the Mulberry tree says :—" Let trees make roots the first year and grow, the second year pick carefully and trim. The full product will be about as follows :—Dwarf trees, four feet apart give their maxima the third year after planting; eighteen feet apart they require five years to reach their maxima; planted twenty feet apart the maxima is attained in ten years. These trees grow to a great age, and give rich supplies of leaves for even hundreds of years, after good cultivation and when once firmly established. Count Gasparin recommends planting in rows, twelve to sixteen feet distant, the trees eight feet apart from each other. One acre of Mulberries in full perfection, should feed 80,000 to 100,000 worms, or from 300 to 500 pounds of cocoons, much depending on care, climate and soil. We have given various plans to guide the planter, and would suggest that each agriculturist add to this his practical experience in the planting of other hardy trees, and be guided much by his past experiences, common sense and the good results of his own knowledge.

To Obtain the Seed.

As fast as the fruit ripens it should be gathered; otherwise it will fall from the tree and be lost or devoured by birds. When a portion of the fruit is ripe, spread blankets under the trees and shake them gently every morning during the ripen-

ing season. By this means the ripe berries are disengaged from the boughs, and falling on the blankets, are easily gathered, whilst those that are unripe remain undisturbed.

One ounce of seed properly sown will give about 5,000 young trees. From a single pound of seed, one hundred thousand plants may be reasonably expected. There are in one pound avoirdupois of white mulberry seed, about 322,700 seeds. This therefore allows one seed nearly out of every three to vegetate. From 9,600 to 10,000 seeds weigh about one ounce of Bavarian weight; and at least 300,000 seeds may, on the average, be considered to the pound.

Time of Sowing.

From the first of April to the beginning of May, or even, in favorable situations, should circumstances require it, *so late as the beginning of June*. But it should be remembered that the earlier the spring sowing, the more strength, firmness, and bark the seedling will acquire to resist the attacks of its first winter, which will be the most critical period in the history of the young plant.

Manner of Sowing.

The seed may be sown in seed-beds or nurseries, as best suits the convenience of the cultivator. When land is no object, it will be best to sow them in the nursery, as it will save the labor of once transplanting. Every cultivator knows the fertilizing effects of frost and snow, and consequently ought to avail himself of them at the proper season. Dig or plough the preceding autumn, and leave the ground rough and exposed to the pulverizing action of frost and thaw all winter. The ground should also be ploughed again in the spring; two or three times, if necessary to render it light and friable. Two or three dressings of manure well ploughed in, will be of essential service. The seed may be sown in drills, *at sufficient*

distances asunder to admit of passing between them for the purpose of weeding and hoeing. Roll the seed in plaster of Paris, or mix with mould, then sow it tolerably thick, as in the sowing of onions or carrots.

SUBSEQUENT CULTURE OF THE SEED-BEDS AND SEEDLINGS.

Should the weather be dry, water the seed-beds every other evening. The ground must be stirred occasionally, or the soil lightened between the drills, and the beds at all times kept clean of weeds.

On the near approach of winter, or on the first appearance of what is commonly called black frost, cover the plant-beds with long stable manure, leaves, straw, or matting, and confine the covering with twigs of pine or evergreen, until the middle of the ensuing April.

Transplanting does not appear always to take place so early in France as with us; nevertheless, part of their practice seems worthy of our attention. The plants will soon show themselves, when they must be thinned, if growing too thick, putting them as near as possible two or three inches apart. After having let them come to the size of a goose-quill, it will be necessary, for at least three years, counting that in which they are sown, to tend them during the whole time in the following manner: At their first appearance, they should be thinned; the second year, they are to be pruned of all the small branches up to a foot from the ground; from time to time they must be watered; they must also be thoroughly weeded. There are TWO SEASONS for making nurseries, the SPRING, and the *time of the maturity af the fruit.* Those who choose to sow the *seed* of the mulberry in the *month of April,* must consequently use the *dried seed gathered nine months before,* and less liable to sprout. But those who *sow the fruit* at its maturity, enveloped with all its moisture (or pulp), which seems intended for its nourishment, and to give it, if we may use the

expression, *its first milk*, have generally the pleasure of seeing it put forth with vigor. Besides, the heat of the season, provided the proprietor use the precaution to water the plants, will necessarily cause their rapid growth.

Sowing Broadcast.

This method is extensively and usefully practised in China; and has also been tried with success and profit in New England many years ago. Though culturists generally prefer the crops of standard trees or hedges, and the recent introduction of the Multicaulis may render this process less necessary, yet conditions may exist wherein for special purposes it may be expedient.

On ground previously prepared, sow the seed broadcast every spring; and the next year, when the young plants are covered with foliage, they may be mowed in the same manner that farmers mow small shrubs, and given to the worms. These mowings may be repeated until the stock becomes exhausted, when the land must be seeded again. During one season, the same seedling will bear to be mown thrice; and on different portions of the ground, the mowing may be daily continued according to the demand for the crop, except after very dry weather.

The advantages of this method are, 1. The leaves are gathered with little expense or labor. 2. The same area of ground will produce more foliage. 3. The making of silk may thus be commenced on the first year. 4. Tenants, as well as owners, from year to year, can secure a yearly crop of silk; and the quantity can be increased or diminished as occasion requires.

Transplanting.

On this subject, authors do not precisely agree, and are generally wanting in that method which will be found neces-

sary in this place. For the sake of distinction, we shall divide this section into what refers, 1. *To the seed-bed:* 2. *To the nursery:* 3. *To the hedge:* 4. *To the dwarf orchard:* 5. *To the hedge plantation:* and 6. *To the plantation for standards.*

The Seed-bed.

1. By the Seed-bed we mean that on which not only the *young seedlings*, or plants from seeds are growing, but where they have suffered no transplanting nor other disturbance, except that of being kept clear from weeds. From the seed-bed, according to the time and manner hereafter to be stated, the seedlings are to be transplanted either to the nursery, the hedge, the dwarf-orchard, or to the plantation for standards, according to the intention of the culturist. Seedlings are fit for transplanting when they attain the height of eighteen inches; and generally, on the second year, those not removed before may be transplanted in the nursery. But if they are thrifty, they may remain in the seed-bed until planted out into hedges.

The Nursery.

2. In France, seedlings are transplanted into The Nursery, just after the fall of the leaf. With us, in *April*, or later if there be a probability of the return of frost, parallel furrows are to be made of sufficient depth, *eight feet* asunder. In which, as soon as possible after removing from the seed-bed and taking away the ragged roots as well as shortening the top-root in order to force out lateral roots, the seedlings must be planted *one foot apart* in the rows. When the plants in the nursery are sprung, strip off the side-buds and leave none but such as are necessary to form the head of trees. The buds which are left should be opposite to one another.

The Hedge.

3. *Mulberry Hedge.*—One method of turning into direct

profit and economizing the very ground on which our fences stand, is to turn them into mulberry hedges. The White Mulberry forms an excellent live fence, and when once established is more permanent than any other. Cattle must not be allowed free access to the hedge while young, as they would destroy it altogether; but after it has become a good fence, they may approach it with advantage. The more it is broken and lacerated by cattle, the more impenetrable it will become; as, for every branch broken, a half dozen shoots will immediately start out, till the bush forms a perfect bramble. This mode is, therefore, recommended as accomplishing three important objects: supplying food for silkworms; keeping the trees low, that the leaves may be gathered from the ground by children; and furnishing a good and almost never-ending fence.

Take seedlings two years old from the seed-bed, and set them, *in the spring*, at the distance of *eighteen inches apart*, or, if it is intended to make a thick-set hedge, at the distance of *one foot*. Cut off the tops at four or six inches from the ground, leaving two buds on each plant opposite each other, and removing all the rest. This causes the stock to have two vigorous branches the first year.

To plant the Mulberry successfully in hedge-rows, the plant should not be allowed to rise higher than seven or eight feet. But a few years are suffiicient to raise considerable fields of them in full vigor, sufficient to support an immense number of silkworms; and regular plantations can be formed, by planting the trees at the distance of from six to eight feet asunder; or in rows of eight or ten feet asunder, and the trees at three or four feet distance in the row; a space sufficient for the extension of the branches, sufficient also for cultivation, and for the greater convenience of gathering the leaves. So greatly is this last operation facilitated by the flexibility of the stalks and the superior size of the leaf, that, as we are assured by M.

Perrottet, a child is sufficient for gathering the food for a large establishment of silkworms.

The Dwarf Orchard.

4. *The Dwarf Orchard.*—The dwarf orchard, consists either of the dwarf or bush Mulberry so common in France; or of any mulberry species or variety kept in hedge-size and cultivation. It is in the East Indies preferred to the tree with a high trunk because its leaves are more easily gathered; the trimming less difficult and less expensive; and the sap, having a shorter distance to rise, produces earlier leaves and proportionately in greater abundance. The tree with a lofty trunk must have a good soil and ample room, whilst dwarf trees will grow anywhere, on arid soil and small spaces.

The field selected for an orchard of the dwarf mulberry ought to be ploughed, and after remaining in the furrow about two months, to be manured and cross-plowed, and lastly leveled with a harrow. Lines must then be drawn *nine feet apart*, through the whole length of the field, and the young trees must be planted along those lines, at the distance of *six feet from each other*. After the gathering of the leaves in the third year, the dwarf mulberry may be trimmed, but not before. *This trimming among the French consists in lopping off the branches that have yielded leaves during three years*, and reserving the wood of the preceding and of the current years. The trees thus arrive at a state of productiveness with comparatively little expense of time and labor. It has been recommended to have the rows of the dwarf orchard sufficiently distant to allow a horse and cart to pass between, to convey, during the gathering, the leaves with the greater expedition to the cocoonery. The objection to this is that the pressure of the horse and cart on the intervening space might be such as to injure the vegetation of the trees. To avoid this, it is recommended that the leaves should be gathered into large

baskets and conveyed to a cart conveniently situated; or rather, that light hand-carts propelled by men should be substituted.

The young trees are to be headed to about a foot from the ground, and but two or three branches allowed to grow. The intervening ground may be cultivated with various other productions, especially during the first years. Indeed, it has been recommended by some to give to the ground applied to dwarf orchards or hedge plantations the benefit of meliorating crops, because the soil, according to this opinion, becomes improved, and the intervening crops defray all expenses in the culture of the Mulberry. Potatoes should be between the rows, well manured; so that the whole ground may be rich like a garden.

The Hedge Plantation.

The Hedge Plantation consists of a piece of ground, not only fenced in, but its whole interior planted with mulberries in regular rows at certain distances kept in hedge culture. It was formerly the practice in France to plant out mulberries as standards, and suffer them to attain considerable size; for which gathering-ladders and additional labor were indispensable. The practice is, of late, much changed. It was observed that the young plants in nurseries put forth their leaves much sooner than the standard trees. Of *hedge plantations there are two plans.* In the first, young trees of one year's growth are used. The *hedges* are planted in lines, extending the whole length of the field, these lines separated from each other by a space of *six* or *eight* feet. Each tree is planted at the distance of *three feet* from the next in the same row. So that *in the space of an acre or 43,560 square feet, we shall have 2,420 trees. They will yield, in their third year, about two pounds of leaves each (or 4,840 pounds for the acre);* and this quantity will be doubled annually until the eighth year, provided they are managed as required.

The above statement leads to the following statistical consequence: the trees on one acre for the

3rd	year	yield,	4,840	lbs.	of leaves.
4th	"	"	9,680	"	"
5th	"	"	19,360	"	"
6th	"	"	38,720	"	"
7th	"	"	77,440	"	"
8th	"	"	154,880	"	"

Which, in this case, on the eighth year, would be equal to 1,548 pounds of silk, worth $7,740. One hundred pounds of leaves of the White Mulberry are reckoned to be equal to one pound of raw silk, now worth at least five dollars.

The second plan of the *hedge plantation* requires that at two years old the trees should be planted out into *hedges* at *eighteen inches apart*, in rows *eight feet asunder*. The ground should be prepared as before directed, and some good rich mould put into the holes, to be afterwards pressed around the plants. The hedges should never be permitted to grow higher than six feet, so as to keep them within a convenient height for gathering the leaves. After the leaves have been gathered, they should be pruned, and, particularly, of such branches as may have been injured or killed. All dead branches, also, thus found in the beginning of April, must be pruned from the living wood with sharp hedge-sheers, and these prunnings should be so regulated as to give a proper form to the hedge.

The planting of *Morus Alba* in the hedge form will be found to be the most advantageous. The same quantity of land will thus produce at least eighty per cent. more leaves than from standard trees; and the labor of gathering leaves is full one half less, and the vegetation is much quicker. A few standard trees, or a *plantation* of *standards*, should be kept on every estate (particularly when situated in the interior), for the purpose of deeping up regular supplies of seed, and of making that of leaves doubly secure.

Plantation for Standards.

Plantation for Standards is a piece of ground, on which, at proper distances, mulberry trees designed to arrive at (or that have attained to) full growth are planted. The distances generally recommended for this purpose are *twenty feet between the rows*, and *twenty feet asunder; i. e. twenty feet every way*.

Pruning.

Trees left to themselves are liable to assume forms as unsuitable to the taste of the horticulturist as inconvenient to those engaged in the gathering of their leaves. *June* is the *best season for pruning*, when the young twigs that are taken off may be, with advantage, given to the worms But after what has been already said, it is here only necessary to add that the imperfections in the form and growth of trees may easily be remedied by a judicious cultivator at least once every two or three years.

Suckers.

Trees may also be obtained from suckers. These, each with some roots attached to them, may be separated from the tree early in the spring, planted in the nursery or orchard, *two feet* apart, where they may remain until their size intimates the propriety of transplanting. They must be treated as seedlings or cuttings; watered in dry weather, and kept clear of woods.

Cultivation of the Multicaulis.

Cultivation by Cuttings and by Layers is divisible into *four methods*, of which *two refer to cuttings*, and *two* to the method by Layers.

I.—Cuttings: Method 1st. *By previous forwarding of the budding or vegetating process in frames or under glass.* Let

there be prepared, before the month of March, frames or boxes of convenient lengths, and sufficient in number to contain the cuttings on hand. Let the depth of the front of these frames or boxes be about eighteen inches, that of the back two feet; and width two feet and a half. If these be boxes having bottoms, they must be perforated, to allow of a constant communication (on account of the draining off or admission of moisture) with the external soil. To these, glass-frame tops opening by hinges should be provided.

Prepare also a mixture composed of rather more than one-half, or nearly two-thirds of *well-rotted* stable or other manure (it has been said that all *fresh* manure is poison to the mulberry), and the rest of a *light, dry mould*, sufficient in quantity to fill the frames to the depth of from twelve to fourteen inches. Place these on the ground where they are intended to remain, in a position facing the sun. The trees intended for this use, cut into pieces of two, or two and a half inches, or always of such lengths as to have each at least one bud, which should be near the end. In the frames or boxes containing the mixture already described, *about the first of March*, stick these cuttings, with the bud always uppermost and turned towards the south, but the whole cutting inclined with its head towards the north, at an angle of about forty-five degrees. Place them in rows about half an inch asunder, and at about the same distance in each row; or in such wise that the one shall not touch the other. Press the earth around them with the finger and thumb, covering over the bud about the fourth of an inch. On mild, warm days, open the glass tops to admit air; but on the approach of frost, especially at night, close the glasses and cover with matting or other protection. Or rather cover with mattings every evening before sunset, and keep them on next day until the sun has attained considerable power. To prevent the escape of the heat of the bed from the sides, let a few inches of horse manure be placed around them. Two or

three times a week, just before putting on the matting for the evening, let the bed be gently watered with water that has been previously exposed for a day or two to the sun. And when the plants come up and begin to put forth leaves, some plaster of Paris should be sprinkled over them. From the first to the middle of May, the plants will be from four to eight inches high, and may then be transplanted to the place where they are intended to grow. For this purpose, on ground previously prepared as already directed, with the plough describe parallel rows, *three feet asunder*, on each of which let holes for the reception of the plants be made one foot apart. With a transplanting trowel, if possible soon after a rain, take the plants up carefully with as much earth as possible attached to the roots. Insert these in the cavities prepared, draw the earth around, press about them with the finger and thumb. Water them for two weeks daily, especially if the weather be dry; or until the plants give evidence of having freely commenced drawing their sustenance from the soil. If the whole of this be attended to, very general success will be the consequence; and the plants will grow, during the season, from four to six feet, and will ripen their wood so that the ensuing winter will not injure them.

Method 2nd. *By open cultivation without previous budding.* It is strongly asserted by some that two buds instead of one are necessary on each cutting whenever planted in open culture. For this, let the ground be previously prepared with well-rotted barn-yard or other stable manure; or, in want of it, with a mixture of ashes with fine mould, in the proportion of 150 bushels of the former to four loads of the latter to the acre. Having plenty of this or other suitable compost, manure broadcast, otherwise in the furrow, or even in the dibble, as is sometimes done for corn. After ploughing and harrowing, strike off furrows *north and south*, three feet asunder, in which, one foot apart, and at an angle of forty-five degrees, the heads

pointed to the north, place, *about the last week of April*, the cuttings, one inch under the earth, with the upper bud facing the south. Draw the earth around the cutting, so as to cover the bud about one quarter of an inch and press the earth tightly around it. Water them for a few days if there be no rain. As the sprouts appear, let the hoe draw some mould carefully round them so as to give the roots depth of soil for their nutriment. Let the weeds be kept down, and the ground kept frequently turned over and fresh; and a good crop of trees may be insured.

Layers.

Method 3rd. *Layering by the whole tree, without branches.* Trees are layered either by the whole tree, or by first taking off the lateral branches and then layering each separately; the latter plan is preferable, since it allows sufficient room for the young shoots to grow. For this purpose, let the ground be duly prepared and pulverized by ploughing, harrowing, and if necessary rolling; and manure, at least in the drill, with the compost already mentioned or slaked ashes. *About the last week of April*, run a plough or cultivator through the land, as if for corn, in parallel lines three feet asunder; and let each furrow be three inches deep. One person lays the tree in a horizontal position in this furrow; the root of one plant being placed at the top of the one preceding it; and proceeds thus to the end of the line. Another follows him with a hoe, and draws the earth over the prostrate plant, covering it with mould to the depth of from one to two inches; though care should be taken not to bury it too deep.

Method 4th. *Layering by sections* deserves the attention of culturists. Cut the tree into pieces of from twelve to fifteen inches; and having prepared the soil *at the same season* as already directed, place these sections in the plough-trace in such a manner that there will be a piece of the plant alternat-

ing with a space of equal length intervening between it and the next section. The intention of this is to admit more freely the sun and air between the plants, and also to favor the growth of the offshoots or branches; for these, by the last method, will be, from the closeness of the trees, few compared with the number of buds which otherwise would produce a plant.

The Osage Orange.

The *Maclura*, or Osage Orange, affords a good substitute for the mulberry, and will make excellent cocoons. This is a spreading, deciduous tree, and at maturity is from twenty to thirty feet high, with a yellow axillary berry the size of an orange, but not so succulent, though said to be agreeable when fully ripe. It was originally found on the banks of the Little Missouri or Washita river; also on those of the Red river in Louisiana, and of the Arkansas river. It is rapidly spreading over the Southwest; and is a valuable tree for hedges as well as for ornamental variety. It begins to find a place in our nurseries, and will soon be generally known on account of its beauty.

The Association has had ribbon of good quality made from pure Osage Orange silk. The worms feed freely and continue healthy, and little difference exists between the silk of the Osage Orange and Mulberry. Yet the Association recommend, where food must be planted, and where families intend to go into silk culture in good earnest, that the time-honored Mulberry should be planted.

State of Leaves proper for Feeding.

Notwithstanding that all silk-growers who have favored us with the result of their experience have recommended the feeding with *dry leaves*, or *leaves free from both dew and rain*, two articles appeared in the September number of the *Silk*

Culturist of 1837 affirming that leaves wet with either were innoxious to the insect and not prejudical to the cocoon. Nothing, however, can be more contrary to the advice generally given. The preservation of the health of silkworms depends essentially on the leaves being perfectly dry when given to them. Wet leaves invariably produce a diarrhæa. The worst leaf that can be given to the silkworm, and which always injures it, is that which is covered with what is termed *manna*, arising from a diseased state of the tree. The *blighted or rust-spotted leaves* do not injure. The worm will eat this leaf, carefully avoiding the spots. If the culled leaves are properly preserved from *heating*, *moulding*, etc., what is called *wilting* will not hurt them.

Feeding by the green leaf.—Let a mulberry hedge be provided in a warm situation having a southern exposure, and on the north and north-west well protected by buildings, plantations, or woods. As the worm in their first age consume but little, a garden-border will afford sufficient for the purpose. Or, we may sow the seed broadcast or in drills in a forcing border or hot-bed to meet the first wants of the insect; and to be provided in the event of some temporary disappointment.

Feeding by leaf powder.—Leaves for this purpose may be taken from the tree towards the close of summer, and dried so effectually as to admit of being reduced to a fine powder, and afterwards preserved during the winter. In the spring, after gently sprinkling with water as much of this powder as may be wanted, allow it slightly to macerate or acquire general moisture; when given to the early hatch, they will be found to attack this powder with an avidity not perceptibly differing from that with which it would consume the early leaf.

During the experiments of the past, when silk culture became a speculation and consequently a failure, a farmer in a vicinity not far from Mansfield, Connecticut, pur-

chased a farm on which were standing twelve mulberry trees of full growth. Knowing nothing of the business of making silk, he supposed them to be of no more than the ordinary value of forest trees for fuel. A neighbor, however, soon called upon him and agreed to pay him twelve dollars annually for the privilege of picking the leaves. The farmer, to his astonishment, found that the twelve mulberry trees were as good to him as $200 at six per cent. interest. And we advocate the system of a Mulberry Leaf Market, as being especially beneficial to citizens in moderate circumstances without land. It is particularly understood, however, that *the leaves at the tip end of every twig are always to be preserved*, to draw the sap and preserve the life and vigor of the tree. There are few farms in this country that could not be four-folded in value by adopting the plan of letting out trees. The children of poor families might be profitably employed in picking the leaves instead of running about the streets contracting habits of vice.

The following extracts from the personal experience of those who raised large quantities of trees and worms in the year 1838 may be useful to those contemplating:

IMPORTANT TO SILK-GROWERS.

"It gives us much pleasure to communicate to our patrons "and the silk-growing public, the results of some experiments "that we have made in the cultivation of the Chinese Mul- "berry, considered by us of the first consequence. We have "heretofore recommended, and now earnestly repeat the "advice then given, that permanent plantations of Mulberries "should be managed according to the directions given in the "leading article of our first number, viz.: to sever the trees "near the ground late in the fall, and feed the worms with the "foliage which will spring from the stumps and roots left in "the ground the next season. We have cultivated the tree

"in this way, and can assure our subscribers, that it is at-
"tended with great conveniences and advantages, as it in-
"creases the quantity of leaves, and facilitates their gathering.
"We have about 1000 roots which have been cultivated in
"this manner, and they have prospered equal to our wishes,
"and more than fulfilled every expectation. The shoots are
"now five and six feet in height, bearing numerous large
"leaves, and the whole ground is nearly covered with their
"rich vegetation. Six, eight and ten sprouts generally pro-
"ceed from one stump, which will rise ten feet in height in
"one Summer. By the middle of June the leaves will be
"large and sufficiently abundant to feed worms to advantage,
"and one man may, by passing along the rows with a sharp
"knife, cut off the sprouts near the earth, throw them into a
"cart, and thus collect food enough to supply a million of
"worms. In another month there will be leaves sufficient to
"feed another crop of worms, thus doubling the profits of the
"business, at a trifling increase of expenditure. We are not
"theorising, but stating what we have proved by our own ex-
"periments. This mode of culture almost demolishes the
"whole expense of collecting leaves, and increases the food
"for the worms 500 per cent. above what can be obtained
"from the cultivation of the White Mulberry. But few of the
"American people have engaged in silk operations, and of those
"few, probably not one half of them, have known anything of
"it, until the five last years. But small as their number is,
"they have effected greater improvements in the business than
"all the Silk-growers of Europe have achieved in a century,
"and if we do not supply England with raw silk within twenty
"years, cheaper than she can obtain it elsewhere, it will be
"because there will be no country called America—no people
"denominated Yankees."

The *prediction* here has been more than verified, American *manufactured* sewing silks being now exported to every part

of the world; but the raw material is still imported. This should not be, with our broad acres. The Association for this cause urge the cultivation of all the Silk needed in the immense factories that are now rising all over our land.

THE REARING OF THE SILKWORM.

The worm commonly employed in the production of silk is called the *Silk Worm of Four Moultings*, of which there are two varieties. 1. Those that form a *straw-colored cocoon;* and 2. Those that produce the deep yellow cocoon. The preference is given to the former; stating that it requires 20¾ pounds of White Mulberry leaves to obtain 1½ pounds cocoons; which is at the rate of thirteen pounds thirteen ounces to one pound of cocoons. Three other *species*, however, are mentioned.

1. *The Small Silkworm of Three Moultings.*—The eggs of this species weigh one-eleventh less than the eggs of the common silkworm; 39,168 of the latter forming an ounce, while 42,260 of the smaller are required to make that weight. The silkworms and cocoons of this species are two-fifths smaller than those of the common sort. Their cocoons are composed of finer and more beautiful silk, and 400 of them weighed one pound; whilst 240 pounds of the common weighed the same.

2. *The Large Silkworm of Four Moultings.*—The eggs of this species were obtained from Frinli. They were only one-fiftieth more in weight, or 37,440 to the ounce. One hundred of their cocoons weighed one pound; and twelve pounds and a half of leaves yielded one pound of cocoons. But the coarseness of the silk counterbalance any advantages derivable from the preceding considerations.

3. *Worms that Produce White Silk.*—Large quantities of these have been raised, and found in all respects equal to the common silkworms of four moultings. The silkworm of three moultings and those that produce white silk are by many considered preferable to any other. And every year the whitest and finest cocoons should be selected to prevent the degeneration of the species. This kind was introduced into France about the year 1783, and is there highly esteemed; but it is supposed to be the same that we have under the name of the "*white worm*," as it produces two crops in a season. That is, hatched at the usual season it will finish its cocoon and deposit eggs that admit of being hatched and raising cocoons during the continuance of the same season.

Lord Valencia found at Jungepore, in Bengal, a species of worm producing eight crops of silk. The distinction between a *one*, *two*, *three*, etc. crop egg is not by some well understood. It means that the eggs of the *one-crop* can be hatched successfully only from the eggs of the *previous year*, kept over winter to the following spring. But the *two crop* eggs may be hatched first from the eggs of the previous year, and next from the eggs of the first hatch of the same season. The *three crop* eggs will hatch from the same season's eggs in so many repeated times. The eggs of one-crop will not produce worms until the following season. One writer says he obtained a silkworm from China, which he reared, and in twenty-five days he had cocoons; and by the twenty-ninth or thirtieth day he had a new progeny feeding in his trap. He remarks that they would be a mine of wealth to those who would cultivate them. The variety Madrassa finish the following course in forty days; six days in the egg, twenty-two days a larva, eleven days a chrysalis, and one day the wings or moth.

The Cocoonery.

It has been recommended by a number of copyists to scrape

the eggs off the paper or cloth, to wash them with water or wine, or to employ other preparations and unnatural manœuvres. Nothing can be more evident than that this is an officious interference with the regular manipulation of nature; any *artificial* misdirection of this kind is, to say the least, superarogatory and detrimental. In this country, it has been abundantly tested that no degree of cold, even down to zero, can injure them provided they are not suddenly raised or depressed from one extreme of cold or heat to another. It is a sudden transition of temperature by which they are injured. Eggs when laid must be kept dry and cold, and preserved in a vessel or by other means from the attacks of insects or vermin; if in summer or autumn, in a temperature not exceeding fifty-five degrees. When spring arrives, they should be placed in an ice-house or some such place where they can be kept in a temperature not greater than from forty to forty-five degrees; for though at some degrees above this they may not hatch, yet they will be liable to addle; as they would if kept in a cellar where the unavoidable dampness of such places promotes this accident, and disappoints the hopes of the silk-grower.

Hatching.

No hatching should at any time be attempted until the mulberry leaves are springing sufficiently to promise an abundant supply during their first and every successive age, as the larvæ increase in size to use them. It is always safer to be a few days too late than too early. In removing the eggs from the ice-house for the purpose of hatching them, care should be taken not to introduce them too suddenly to a change of temperature. They should be cautiously and gradually brought from a cold to a warm atmosphere, until the temperature be from seventy-five degrees to eighty degrees. Otherwise, through the injury from sudden transition, sustained by organization so delicate, they either would not hatch

at all, or hatch and die soon after. The young larvæ, resembling a small black worm, generally appear from sunrise to ten o'clock in the morning. The tender leaves of the mulberry should be in readiness scattered on the trays, shelves, or table where they are placed, and the attendant should be up by the dawn of day to watch them. Those that do not leave their shell by ten o'clock, usually remain until the next morning. It is important to keep the worms of each day's hatch by themselves; which may easily be done by the leaves placed near them for their early sustenance, to which those that have left the shell will immediately and instinctively attach themselves, and are therefore thus easily separated and removed wherever the person tending them choses. The hatch of any one day particularly, if sufficiently large, should all through the season be kept by itself; but never should the hatches of more than two consecutive days be placed together; as they cannot thus pass, during the time of feeding, through the several moultings together; and the consequence will be that on the same shelf worms will be found eating voraciously, whilst others are sick or in the act of moulting; worms in different states, requiring different treatment, which will be inconvenient if not detrimental. The silkworm at no time evinces much inclination for motion; and if properly fed and provided, will not travel beyond the distance of two or three feet throughout the whole of its pilgrimage from the egg to the cocoon. But when the young worm first appears, unless food be near, it displays considerable activity. Its strong desire to eat, which it immediately manifests, impels it to wander anywhere for food. But if this desire be satisfied by an adequate and timely provision, they seldom show an inclination to leave the shelves on which their wants are supplied. Should this at any time take place, which will only be occasioned by hunger, the mere smell of a leaf is sufficient to bring them back to their domicile. This disinclination to

locomotion is one of the greatest advantages of the *domestic* over the *wild* silkworm; otherwise, the trouble consequent on their attendance would be immense. But our attendance on their little but important wants is an interesting specimen of the union of profit and amusement.

The period of moulting is about twenty-four hours, during which it lies in a torpid state and refuses to eat. They are then greatly injured by disturbance; and the feeding or attendance necessary to one, must not be allowed to disturb another in a different condition.

Diseases from the bad air of the district in which silkworms are reared.—Low marshy places, productive of noxious vapor; all situations where the air is liable to become stagnant; and certain effluvia, especially that from tobacco, are injurious; the latter being speedy death to the worms.

Diseases from want of room.—When silkworms are on the shelves crowded too much, they become unhealthy. In removing them, the hand need not be applied to the insect. It is only necessary to apply another hurdle with fresh leaves in it to the side of the shelf where the crowded worms are. Silkworms breathe through little orifices, or spiracula, situated on each side near their legs. Consequently, being crowded is to them a greater mechanical obstruction than it would be to animals otherwise constructed.

Diseases from the quality or quantity of food.—The worms should be fed with great attention to their peculiar wants. Dry leaves, fresh as possible, being given, after having lain a day in a cool place, thinly spread to prevent heating. In anticipation of rainy weather, a supply for three days may be procured. Leaves taken from trees growing in moist soil and shady places are not proper. Over and under feeding may equally produce disease. The leaves after being pulled

may be exposed to the sun a few minutes, and then set in a dry place to cool.

Diseases from improper change of food.—Changing the leaves of the red for the white, or other species of the mulberry, is sometimes detrimental. The leaves of different species should no be given at the same time; much less, any leaf of inferior quality be administered at the last stages of feeding.

Diseases from peculiar constitution of the air.—The farmer, the horticulturist, the orchardist, all complain of unfavorable seasons; and the medical man or his patients of endemical and epidemical times. And whether we have the influenza or the cholera, we lay the blame to the air, and demand of the meteorologist its component parts. But all this time a myriad of evanescent things, hidden from eye, from ear, from sense, may be in operation. All we can do is to use the precautions already prescribed.

Diseases from sudden changes of temperature.—We must ever remember that the insects are tender, and therefore, we should be provided with every suitable means to correct any sudden variation in temperature.

The Passes.

This disease is known.—First, from the yellow tinge of the worms. Second, from its lengthened spare shape and wrinkled skin. Third, from its sharp and stretched feet. Fourth, it eats little, languishes, and is evidently in a state of atrophy. The *remedies* are instant removal from the healthy worms to an apartment which is well ventilated and where they can be distinctly attended to. They should have a due supply of tender leaves, and a uniform temperature, but a little higher than that required by the worm in a state of health.

The Grasserie.

This disease generally appears towards the second moulting, rarely later, and is scarcely known in the fourth age. The *symptoms* are 1st, they eat but do not digest their food; hence, 2nd, they swell; 3rd, their bodies become opaque and of a greenish color. The *remedies* are, if not too late, 1st, instant removal; 2nd, lessen the quantity of nourishment; 3rd, give the thin leaves of the wild or of some inferior mulberry; 4th, ventilation and moderate temperature.

The Yellows.

Appearing about the fifth age, when the worms are filled with a silky fluid and about to spin. *Symptoms*, the body swells, and the enlargement of the rings gives to the feet an appearance of being drawn up. *Remedy*; 1st, instant removal, as on all similar occasions; 2nd, ventilation, assisted by fires, if necessary; 3rd, in two cases, oak leaves were given with success.

The Tripes, or Mort Blanc.

Symptoms, the worm becomes flacid and soft. When dead, they preserve a fresh and healthy appearance, and on being touched they feel, it is said, like *tripe*. *Remedies*; 1st, instant removal; 2nd, dry the air of the infirmary by sudden flash fires under chimneys provided for the purpose. Chloride of lime is a fumigator and purifier.

Of worms, through negligence, the French formerly lost fifty per cent.; whilst the Chinese scarcely lose one per cent. This difference, carried out into the million, is 490,000 worms; or a difference in Silk of 163 pounds, worth $815; sufficient to show the value of the timely care and vigilant attention of our *five weeks'* services, for which the little generous animals will pay us so liberally.

Enemies to the Silk Worms.

The enemies of Silk Worms are *sparrows*, *swallows*, *robins*, *titmouse* and *poultry*. Care must therefore be taken to exclude them. Besides these, such vermin as mice, rats, weasels, lizards ants and spiders are to be catalogued as enemies. The last are said to make the most active war against Silk Worms.

One point in Silk culture which may be considered an element and therefore, important in statistical calculation. Count Dandolo says: "To make one ounce of picked eggs there should be for an average weight 39,168 eggs. *I have observed with some surprise, that there was little difference in the weight of eggs belonging to about twenty persons.*" The Count, therefore, had ascertained this fact by at least twenty distinct trials. Where have we another example of patient investigation equal to this? Not one! So easy is it to copy, or to quote the words of another as *our* doctrine; so difficult to be original.

Space Statistics.

The Worms proceeding from one ounce of eggs should have a space:

In the 1st age, of	. .	7 feet,	4 inches	square.
" 2nd "	. .	14	8	"
" 3rd "	. .	34	8	"
" 4th "	. .	82	6	"
" 5th "	. .	183	4	"

Ages.	FEET SQUARE REQUISITE ON THE SHELVES FOR WORMS PROCEEDING FROM									
	One Ounce	Two Ounces	Three Ounces	Four Ounces	Five Ounces	Six Ounces	Seven Ounces	Eight Ounces	Nine Ounces	Ten Ounces
1	8	16	24	32	40	48	56	64	72	80
2	15	30	45	60	75	90	105	120	135	150
3	35	70	105	140	175	210	245	280	315	350
4	83	166	249	332	415	498	581	664	747	830
5	184	368	552	736	920	1,104	1,288	1,472	1,656	1,840

Mr Strong of Germantown, from an experiment with five ounces, furnished from the seventh to the thirty-third day the following statement, by quoting the number of hurdles requisite, *each twelve square feet.*

DAYS.	HURDLES.	DAYS.	HURDLES.	DAYS.	HURDLES.
7	11½	16	34	25	70
8	13	17	34	26	70
9	13	18	34	27	87
10	13	19	34	28	87
11	13	20	34	29	87
12	18	21	34	30	87
13	27	22	51	31	90
14	27	23	61	32	108
15	38	24	70	33	112

Unless we can in all climates of this Union from Maine to Louisiana, and in all years, through May and June at least, promise ourselves a temperature of not less than 75 degress, the use of a *thermometer* and the means necessary for raising the temperature to that degree, is advisable. One of the foundations of the art of rearing silk worms is to know the various degrees of heat in which the silk worms should live; if this precept be not enforced, nothing can be performed with exactness. We must not lose sight of the fact that it is not heat that affects the silk worm, but sudden transitions from one temperature to another. If it be necessary to hasten the worms in consequence of the advanced state of the mulberry leaf (which cannot be retarded) it should be done gradually, so that they perceive not the alteration. One year, when hurried by the early growth of the mulberry leaves, the worms were given 100 degrees of heat during the first two days after hatching; and about 95 degrees during the remainder of the first and second age. There elapsed only nine days from the hatching until the second moulting. The walls and wicker hurdles were so heated they could scarcely be touched. All thought they must persish; but all went on well, and a most abundant crop followed. To follow this method it is requisite to observe well the advancement of the season. If the first age of the worms is prolonged, the leaf will grow and harden and become unfit for them. The essential point is that their progress should follow that of the leaf. We must calculate the duration of the different ages of the worm; and so manage that the fourth age shall fall into the time in which the leaf has attained its full growth.

The silk worms *proceeding* from *one ounce* of eggs consume

In the first age.—6 lbs. of *white mulberry* leaves *well sorted* and *chopped very small;* to which 5 lbs. of the leaves of the *morus multicaulis* will be equal.

In the second age.—Of the white mulberry, 18 lbs.; sorted, clean and chopped rather more coarsely than in the first age. Of the *multicaulis*, about 15 lbs.

In the third age.—Of *white mulberry*, 60 lbs. well sorted and less chopped. Of *multicaulis*, 50 lbs.

In the fourth age.—White mulberry 180 lbs., well sorted and still less chopped than that of the third age. Multicaulis, 144 lbs.

In the fifth age.—White mulberry. 1100 lbs. Multicaulis, 880 lbs.

The above is, of course, given as a general rule, or one on the supposition of ordinary circumstances and care. We are informed that even a variation in the season will have an influence on the requisite quantity of leaves. If the leaf be injured by the season, and the proportion of nutritive matter it contains lessened, a greater quantity to produce the same effect will be necessary; and, *vice versa*, if the nutritive proportion of the leaf be increased, a quantity less than the medium prescribed will realize the hopes of the culturist. The above will serve as an outline of manipulation on a small scale. In following out the detail, however, for the sake of variety we will repair to the large laboratory or establishment *for worms proceeding from five ounces of eggs.* It is proper that at the commencement the shelves should be numbered 1, 2, 3, 4, &c., throughout. The quantity of the eggs to be hatched ought not to be more than will leave room, within the cocoonery, and according to the number of shelves that we can conveniently furnish therein, sufficient for the full development of the worms, or for their accommodation at their utmost growth.

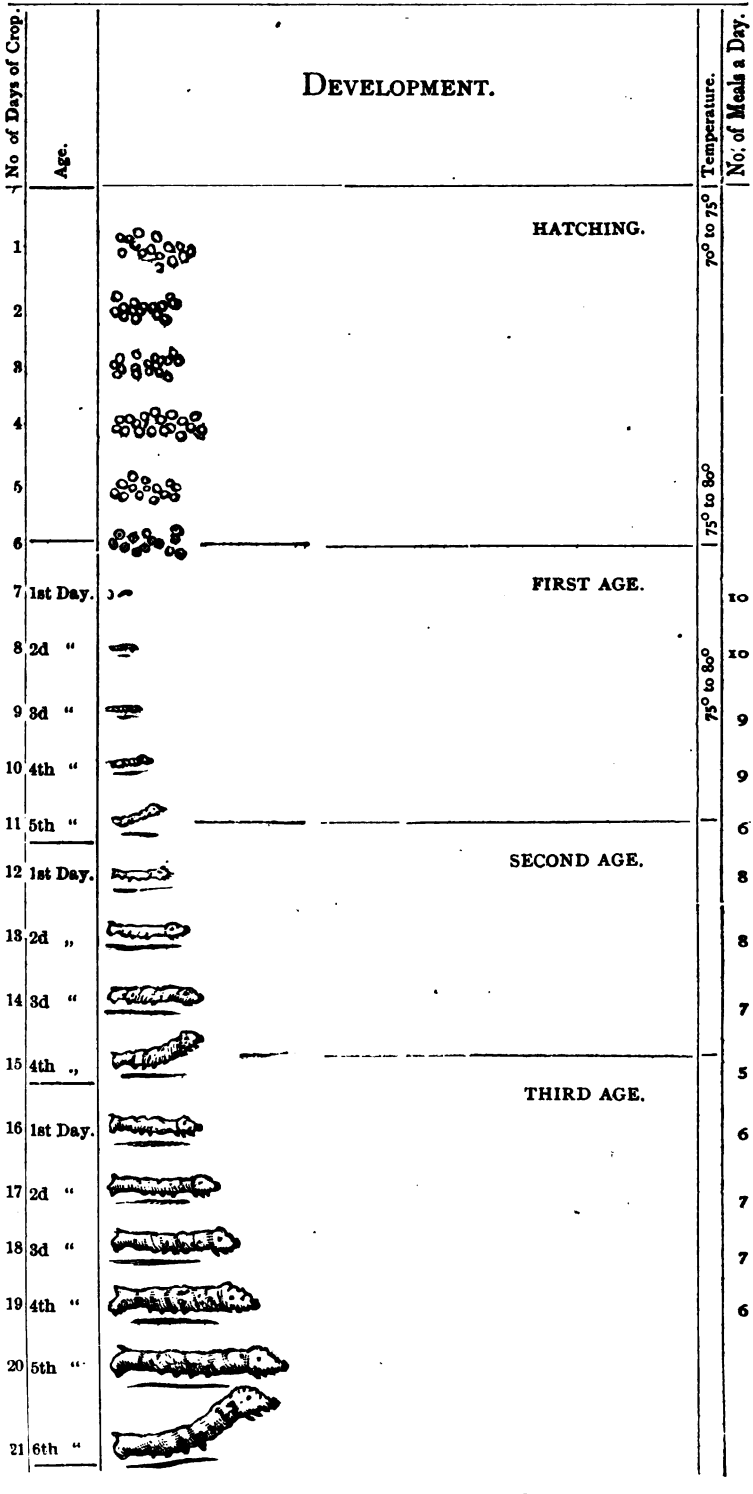
The eggs should have been divided by weight into ounces or half ounces, and each parcel kept apart. It would be better, supposing the number of shelves to be 30, 35, 40 or upwards, to divide into half ounces; and so to apportion them as to

leave a number of spare shelves; and, if the eggs be good, and the produce more than an average, to distribute them into more space than they would ordinarily occupy. But the distribution on the shelves according to the order or date of their hatching, and according to distinctive numbers on the shelves and as duly recorded on a diary, which will be kept by every accurate culturist, should be observed throughout.

Leaves are now to be thinly scatttered over the SHELVES. It is not absolutely necessary that the HURDLES should be used till the third age. The young larvæ will run about and leave the shelves, if food be not given to them immediately after their exodus from the shell. They will never leave the feeding-shelves till they rise to spin, provided they be duly supplied with food, proper in quality, sufficient in quantity, and at the time they require it. The following cut represents the worms just emerged from the shell, during the first age.

Rearing of the Worms.

First Age.—First day.—To the worms proceeding from one ounce of eggs, on the first day of their existence in the larva state, are to be given, in proper proportions, at successive meals, two hours apart, of the *white mulberry leaf*, about three-fourth lbs., chopped *very small;* giving the smallest quantity for the first feeding, and gradually increasing the quantity at each successive meal; of the *multicaulis* leaf, the quantity may be three-fifths lbs. The benefit of giving the leaf, at this early stage of the worm, in a stage of minute division by chopping, is evident. The more the leaf is chopped, the more fresh-cut edges exist, on which the little mandibles of the infant operatives can fasten. In this state they bite the leaf quickly, and consume it before it is withered. If care be not taken thus to chop the leaf small, and to give the young worms sufficient space at first, and more as they need it, a greater number will be liable to perish by disease, or from difficulties they want


No. of Days of Crop.
Age.
DEVELOPMENT.
Temperature.
No. of Meals a Day.
HATCHING.
70° to 75°
75° to 80°
FIRST AGE.
SECOND AGE.
THIRD AGE.
1
2
3
4
5
6
7 1st Day.
8 2d "
9 3d "
10 4th "
11 5th "
12 1st Day.
13 2d "
14 3d "
15 4th "
16 1st Day.
17 2d "
18 3d "
19 4th "
20 5th "
21 6th "
10
10
9
9
6
8
8
7
5
6
7
7
6

Development.

No. of Days of Crop.	Age.	
22	1st Day	FOURTH AGE.
23	2d "	
24	3d "	
25	4th "	
26	5th "	
		FIFTH AGE.
27	1st Day	
28	2d "	
29	3d "	
30	4th "	
31	5th "	
32	6th "	
33	7th "	
34	8th "	
35	9th	

Temperature

70° to 80°

strength to encounter at an age so early. The worm that cannot eat, dwindles, becomes extenuated, weak, and unsupported; and, consequently perishes under the leaf. Count Dandolo fed his worms regularly four times every day.

Second day.—On this day, of the *white mulberry leaf*, give, at four regular meals, about one and one-fifth pounds chopped very small. Let the first meal be the least, and increase gradually to the last; of the *multicaulis*, give about one pound. There will now appear some evident change in the appearance of the worm. It begins to lose its dingy and bristled aspect, and the head perceptibly enlarges and whitens.

Third day.—Give at four meals this day, of *soft, white mulberry leaves*, chopped very small, about two and two-fifth pounds; of the *multicaulis*, about two pounds. The worms are now feeding with avidity. The head of the worms continues to become whiter, the insect to grow larger, the former bristly appearance to vanish, and the skin is assuming a sort of hazel color. When viewed through a convex lens, their surface looks shining, and their head a silvery white, somewhat like mother-of-pearl and transparent.

Fourth day.—As the worm approaches the moulting, a diminution of appetite occurs. Of the *white mulberry*, give about one and one-third pounds, let the first meal be about one-half pound, and the rest gradually decrease to the last. Of the *multicaulis*, give about one pound, one ounce. And let it be remembered, that in this first age, it is of importance to give the insects plenty of room by gently separating and spreading them, to avoid as much as possible their sleeping, on the verge of moulting, in heaps. At the beginning of this day, the first appearance of the approaching change are indicated. The worms begin to shake their heads and thus express uneasiness at the increasing tension of their skin. Some are now eating

very little; keep their head in an elevated position, their body appears transparent. Those nearer the moulting time, when seen against the light, are of a yellow, livid tinge; but the greater number at the close of the day, appear torpid and cease to eat.

Fifth day.—Of the young leaves of the *white mulberry*, three-tenths pounds only, chopped small, will be sufficient. These chopped leaves, scattered lightly on those parts of the shelves where worms appear to be still feeding. Of course, where variations from the general state be perceived, and some are still willing to eat, more leaves may be given. The discretion of the careful superintendent, here and in all similar cases, must be given. Towards the end of the day, however, in the general case, the rooms are torpid and a few begin even to arrive. After the first moulting, the silk worm is of a dark ash color, showing distinctly a peculiar vermicular motion; and the rings that mechanically assist that motion contract and dilate their intervening distance more freely than before.

Second Age.

About fifteen feet square of shelf space will be for the accommodation of the growing family proceeding from one ounce, necessary until the accomplishment of the second moulting, or completion of this second age. These should always be covered with strong paper or proper paste-board. The temperature during this age should be between seventy-three and seventy-five degrees. *Prescribing* as to temperature in a hot country appears, of course, somewhat arbitrary. Our only means of *commanding* the temperature is to use large fans suspended from the ceiling. Silk worms of the first day should be placed in the coolest parts of the laboratory, and the latest hatched worms in the hottest part.

Important changes are effected by the first moulting. The organs assume greater consistency. The scaly muzzle which

they lose by moulting is replaced by another which the air indurates; and till the small jaws or mandibles have acquired sufficient hardness, they cannot, in certain cases, divide the leaves with an expedition equal to what their seasonable advance to maturity requires. With the aid of a convex lens, we immediately perceive the efforts to the expense of which an unassisted worm is liable at this age in gnawing the leaf.

Sixth day.—Of the *white mulberry* give now four-fifth lbs. of leaves well picked and chopped small. Of the *multicaulis* this is equal to 3 lbs. Experience has proved that the silk worms like the tender boughs so much that they remain crowded on them even when the leaves are consumed, and evince a reluctance to return to the litter below. This remark will doubtless afford a hint to the provident culturist in affording the requisite accommodations for the health and comfort of animals that repay in proportion to the care expended on them. When the worms have been removed to clean hurdles, those they have left should be thoroughly cleansed.

Seventh day.—Of the *white mulberry* give 6 lbs. of chopped leaves; divided into four portions to be given at intervals of six hours; but an improvement would be to divide into ten or twelve portions, given at intervals of two or three hours each. The first meals less plentiful than those which follow. Of the *multicaulis*, this quantity is equivalent to 5 lbs. The body of the worm now acquires a clear hue; the head enlarges and becomes whiter. Continue to pay unremitting attention to the equal distribution, as to space, of the worms. Place boughs wherever they appear to be too thick; on which they will immediately fasten, and may thus be removed or distributed to fill up places not sufficiently covered.

Eighth day.—Give now, of the *white mulberry* $6\frac{3}{6}$ lbs. of chopped and well-picked leaves; and at this time let the two or three first meals be the largest. Of the *multicaulis*, give

5⅞ lbs. These leaves, distribute at each meal with attention, and, as far as possible, proportionate to the degee of avidity discovered by the worm; since it becomes again the period when the voracity of the worm, consequent on the approach of the second moulting, begins to abate; which they soon ndicate by the usual prognostics of rearing their heads and declining to eat.

Ninth day.—Of the *white mulberry*, one and four-fifth pounds only of picked leaves, and chopped small, will be required, distributed in the same manner as before. Scatter the proportions lightly and with discriminating care over the worms. *Of the multicaulis*, about one and two-fifth pounds will be sufficient. On this day, our metempsychosin insect is again discovering its periodic restlessness for change. It is sinking into a torpor. The next day its old wardrobe is disposed of, and it becomes as eager or more of its third life as it was of the first.

Third Age.

Tenth day.—Give of *white mulberry* three pounds of small shoots, and three pounds of picked leaves, chopped small. At the close of the age, they may be more coarsely chopped. To this quantity, four and four-fifth pounds of the *multicaulis* are equivalent. The worms that have accomplished this age should not be removed from the shelves until they are nearly roused. Part will rouse on the ninth and part on the tenth day. No injurious consequence will ensue, if the part that has revived should wait twelve or fifteen hours till the rest are ready. A never-failing sign that they are roused is the undulatory motion they display with their head when horizontally blown over. It will ever be incumbent on the superintendent frequently to inspect the operations of the feeders, to see that the food is at all times equally distributed, according to the varying wants on different portions of the shelves. Redun-

dant leaves, though a loss, is still an inconvenience less than the accumulation of an unnecessary portion of litter. which may ferment and produce noxious evaporation and disease.

Eleventh day.—Of the *white mulberry*, give at separate meals eighteen pounds of picked and chopped leaves; of the *multicaulis* fourteen and two-fifth pounds. The first meals should be the least; the reason of this the worms themseves will explain, since it is in the latter part of the day that they become voraciously hungry.

Twelfth day.—Of the *white mulberry*, nineteen and two-fifth pounds of picked leaves will be wanted, chopped and divided into the usual number of meals; the first being most plentiful. Towards evening, the hunger begins to abate, the last meal therefore on this day should be the least. To this quantity of the *multicaulis*, fifteen and three-fifth pounds will be equivalent. The worms now grow fast; their skins become whiter, their bodies semi-transparent, and their heads longer, and the contortions they make show that their change approaches.

Thirteenth day.—Ten and a half of chopped *white mulberry* leaves will now be sufficient. Eight and two-fifth pounds of the *multicaulis*. Give in the usual number of meals, the largest first, the last meal the least, feeding those only that require it. Should a greater number of worms on one table be torpid, whilst others continue to require food, give only a slight meal without waiting for the stated hour of feeding, in order to satisfy them, that they may sink into torpor speedily. Care of this kind is important, and intermediate meals occasionally given and by discretion administered, are beneficial.

Fourteenth day.—Of the *white mulberry* $5\frac{2}{5}$ lbs. of picked and chopped leaves will be sufficient, in ordinary cases, more or less, as occasion requires. To this medium supply, of *multi-*

caulis leaves $4\frac{2}{5}$ lbs. will be equivalent. Indications of silk now begin to appear from the occasional depositions of the the insect. The worm now manifests inclination for solitude and free space to slumber in. It either climbs the edge of the paper, the elevated stalks or leaves, or in failure of that, on the litter; it rears its head and expresses its uneasiness. Immediately on the verge of change, they void all gross excrementitious matter; a yellow and semi-transparent lymph only occupies the intestinal tube, and constitutes nearly the only fluid remaining in the animal. This also is that which prior to their change gives them a yellowish white color like amber. Whilst the worms thus prepare for the moulting, sufficiently clear, by moderate ventilation the air of the cocoonery.

Fifteenth day.—On this day the rousing of the silk worms, which they begin to manifest, is an inclination of the completion of the third age.

Fourth Age.

The worms, with proper care surviving now from one ounce, should have a space equal to 82 square feet, and should be equally distributed as already prescribed, and the temperature should not be less than 68 degrees nor higher if possible than 71 degrees; but whenever it rises, as, at this season, it inevitably may, greater compensating means must be sought by the instant removal of all litter liable to fermentation; and promoting by ventilators and other means, a due circulation of air in the cocoonery. We must again insist on the impropriety of lifting off the hurdles those silk worms that have completed their third age until nearly all are roused. The one part waiting a day, or even a day and a half, for the other, is, as said before, not injurious. It is, however, advisable to place the early roused in the coldest part of the laboratory; be it remembered the appetites as well as the growth may be thus artificially retarded. If this be inconve-

nient or impracticable, give to the early roused less space ; and to the late roused, more space. By both these means, their advance towards the maturity of their fourth age will be so preserved that they will moult together, which is important.

Sixteenth day.—On this day give 7½ lbs. of the young shoots, and 12 lbs. of picked leaves of the *white mulberry* coarsely chopped with a large blade. To this quantity 15⅜ lbs. of the *multicaulis* will be equal. When the moment of removing the worms from the hurdles arrives, one or two hurdles only at a time should be covered with young shoots. These shoots, loaded with worms, are afterwards put on the empty shelves, and removed, as in the first moultings. Should there not be a sufficiency of small boughs, branches of 15 or 20 leaves of white mulberry tied together by the stalks, will answer the purpose. The removal should be effected by three persons ; one to fill the shelves, one to carry them, and another gently to remove them from these shelves on the hurdles, in the space allotted to them. When those which have revived are removed, others yet remain torpid on the 35 feet square of hurdles, or that have not yet strength to climb on the shoots or branches of leaves. But it will be discovered that the early roused have probably by this time eaten all the leaves on the young shoots or branches that served to carry them, and that they remain without food on the shelf. They should then be suppled with 6 lbs. of *white mulberry* chopped a little, or with 5 lbs of the multicaulis. The other 6 lbs. of leaves should not be given until the second meal has been thoroughly consumed.

At the end of this day, the worms begin to evince renewed vigor; they move more nimbly, they grow perceptibly, they lose their ugly color, become slightly white, and assume more animal vivacity.

Seventeenth day.—23 lbs. of the white mulberry, slightly cut up, will now be wanted. The first meals should be the lightest; the last, most copious. 26 lbs. of the *multicaulis.* The worms now grow fast, and their skin continues to whiten.

Eighteenth day.—45 lbs. of the sorted leaves of the *white mulberry*, a little cut; or 36 lbs. of the *multicaulis*, are at this time the proper preparations. The former meals of the day to be the most plentiful.

Nineteenth day.—Of *white mulberry*, the cut leaves to be distributed at successive meals, should amount to 51 lbs., the first meals of the day still being the larger in the proportion of about 5 to 3. To this quantity, 41 lbs. of *multicaulis* are equal. The worms continue to become whiter, and measure in size to $1\frac{1}{2}$ inches long.

Twentieth day.—Reduce $25\frac{3}{5}$ lbs. of the picked leaves of *white mulberry*, since on this day the appetite of the larvae diminishes; or of the *multicaulis* give $20\frac{3}{5}$ lbs. Let the first meal be the largest, and gradually lessen until the last. Several are beginning to become torpid; therefore, with discrimination give leaves, to prevent both waste and also avoidable fermentation, only as they are wanted. The worms are now $1\frac{3}{4}$ inches long.

Twenty-first day.—Of picked leaves of *white mulberry*, seven pounds; of *multicaulis*, five and three-eight pounds are sufficient for the day. The changeable animals under our care are now decreasing in size, since they lose part of their substance before they sink into torpor. The greenish color of their rings becomes changed, and their skin is now wrinkled.

Twenty-second day.—The worms rouse on this day, and thus accomplish their fourth age.

Fifth Age.

Twenty-third day.—At this time nearly all the worms are roused, or have accomplished their fourth moulting. The laboratory should be sixty-eight or seventy degrees; and the tenants, for they pay good rent, must be accommodated with premises equal to one hundred and eighty-three square feet. In the first day of the fifth age, the worms should fill a space of about one hundred feet square on the shelves, which added to the eighty-two feet which they occupied during the previous age, and which should now be cleaned, form together one hundred and eighty-two feet square on which they are gradually to spread, until the termination of this state. This day, about eighteen pounds of the young shoots of the *white mulberry*, or of common leaves not sorted, and also eighteen pounds of picked and sorted leaves; in all, thirty-six pounds, which is equal to twenty-nine pounds of *multicaulis*. The eighteen pounds of shoots and leaves on which the worms were removed, furnish an abundant meal. The *other eighteen pounds of sorted leaves should be divided into four meals, which should be given to them every three hours.* In giving the first meal, care must be taken to straighten the lines of the strips on the hurdles, by sweeping any straggling leaves or worms into regular order with a little broom.

In the preceding age, one hundred and eighty pounds of leaves were distributed and the litter of that age weighed sixty pounds. The worms, therefore, derived sustenance from one hundred and twenty pounds of the substance, including the loss by evaporation. The excrement weighed about eighteen pounds.

Twenty-fourth day.—There will be wanted on this day, of *white mulberry*, fifty-four pounds of leaves, sorted, and divided into eight feeds. The first should be the least of about five pounds, and the last the most plentiful, or of about nine

pounds. Of *multicaulis*, forty-three pounds for the day, of which the first and last feeds four and seven pounds respectively; the intermediate feeds increasing by a corresponding ratio.

Twenty-fifth day.—The worms will now require of *white mulberry*, eighty-four pounds of sorted leaves, divided into eight meals, the first smaller increasing to the last. Of the *multicaulis*, sixty-six pounds for the whole day. On this and the preceding day, the worms continue to whiten, many are now upwards of two inches in length.

Twenty-sixth day.—Our propotions must be of *white mulberry*, ninety pounds of sorted leaves; intervening feedings increasing. *Multicaulis*, for the whole day, eighty-six pounds. The voracious period of the worm is now rapidly advancing. Some are now two and a half inches long.

Twenty-seventh day.—Of *white mulberry* for the whole day, 162 lbs. of picked leaves will be wanted. Of the *multicaulis*, 125 lbs. for the whole day. If necessary, the worms should now have intermediate feeds. When the regular distribution of leaves is devoured in less than an hour and a half, the worms need not receive any until the regular feeding, which it is understood is every three hours.

Twenty-eighth day.—Give now of *white mulberry* 195 lbs. of picked leaves, divided into eight feeds, the last of which to be most abundant. Of *multicaulis* 156 lbs. similarly divided. The worms now eat most voraciously, and some even attack the fruit which is among the leaves. An intermediate meal may be added when it appears necessary, as may be inferred when the full quantity necessary to constitute a meal, is devoured within an hour. Some of the worms are now three inches long; have become whiter, and present to the touch a velvet surface.

Twenty-ninth day.—180 lbs of *white mulberry*, well sorted, will be required this day; or 144 lbs. of *multicaulis*. The first meal should be the largest, the later diminish gradually; but should the necessity of any intermediate meals be indicated, as it would by the sign already stated, it should at this important crisis be given.

Some of the worms are now upwards of 3 inches in length; in certain cases, from extraordinary health and good attention, they are known, in this country to attain the length of even four inches. The extremity of the insect begins to grow shining and yellowish, their voracity abate, which intimate their arrival at maturity; in size and weight, on an average, eleven of them will weigh two English ounces avoirdupois.

Thirtieth day.—The diminished appetite of our cocoonery-boarders requires now only 132 lbs. of the *white mulberry*, well sorted; of the *multicaulis*, 105⅝ lbs. to be given at eight meals; the subsequent feeds to be gradually lessened. Give to backward worms, if necessary, intermediate meals.

Thirty-first day.—Diminished wants now lessen our care to the provision of 99 lbs. only of *white mulberry*, or of 79 of *multicaulis;* which must now be distributed with care and discretion as wanted.

General Remarks on the Fifth Age.

Reckoning 48 lbs. of sorted leaves which are to be given to-morrow, or on the 32nd day, the worms will have consumed during this fifth age 1,098 lbs. of picked leaves. Adding to this, 102 lbs. of additional feed required, the total weight taken from the trees will be 1,200 lbs.

The total weight of excrementitious matter down from the shelves in the fifth age, is about 660 lbs.; which demonstrates that of (1,098–660) 438 lbs., a part served to nourish

the worms and the rest exhaled in vapor. Calculating the weight of the leaves and the loss by evaporation, the worms, it appears, have consumed in their fifth age alone 240 lbs. of leaves per ounce.

Thirty-second day.—During this day, the fifth age will be terminated, and the rising begin. Everything should be cleaned and kept cleaned. The silk worm will now be perfected, which may be known by the following signs. 1, when the insects instead of eating leaves put on the hurdles, get on them and rear their heads, as if in search of something else. 2, when, on looking at them horizontally, the light shines through them, and they appear of a whitish-yellow transparent color. 3, when numbers of the worms which were fastened to the inside of the edges of the hurdles and straightened, now get on the edges and move slowly along; instinct urging them to seek change of place. 4, when numbers of worms leave the centre of the hurdles and try to reach the edges. 5, when their rings draw in and their greenish color changes to a deep golden hue. 6, when their skins become wrinkled about the neck and their bodies have more softness to the touch than before. 7, when on taking a worm in the hand, and looking through it, the whole body appears to have assumed the transparency of a ripe yellow plum. These signs are prognostics of their rising. Of course, everything before this, should have been prepared for the accommodation of the insects, that those which are ready may not waste their strength and silk in seeking the support they require.

No slovenly appendages are needed. They are in a few minutes in their cabins, and after looking about to ascertain in what position they should arrange their building, for the larvæ has forecast; it commences to throw the floss around it. The spinning has now fairly begun. Some may yet linger; they should be placed on a separate shelf, that all the cocoons formed in the cabins above it may be *completed* and *gathered*

at the same time. To the lingering worms, a very small quantity of leaves should be given; but the slightest injury at this age should be avoided as particularly hurtful. It is best to place in their way boughs of oak or heads of broom-corn. The lazy worms will soon be distributed among the branches and begin their work. Avoid dampness. Temperature sixty-eight to seventy-one Fahrenheit. The air may be admitted freely when the cocoons have become of a proper consistency.

Sixth Age.

This age commences in the pupa state, and ends when the moth emerges from the cocoon. The following are the necessary things that remain to be done: 1st. To gather the cocoons; 2nd. To choose those cocoons which are to be preserved for the eggs or seed; 3rd. Preservation of cocoons until the appearance of the moth; 4th. The daily loss of weight which the cocoons suffer from the time they are finished until the appearance of the moths.

Gathering cocoons for seed.—The matured ceterpillar of the cocoonery, or *ateliére*, ceases to eat, ascends to its cabin, elaborates its cocoon, and retires from the gaze of mortals. In three or four days from the commencement of the spinning, the worms have finished their cocoons; and in seven or eight days they will be ready for gathering. Gather them carefully, with all their floss. Then take this off with great delicacy; neither flatten nor bruise the cocoon.

Daily loss in weight of cocoons of 1,000 oz. from the time of fermentation until the moth escapes:

	Ounces.
Gathered and cleaned	1,000
First day following, the said cocoons weighed	991
Second day	992
Third day	975

	Ounces.
Fourth day	970
Fifth day	966
Sixth day	960
Seventh day	952
Eighth day	943
Ninth day	934
Tenth day	925

It is a loss for the purchaser of cocoons to receive those that are of different ages, because when, in some cocoons, the moth is preparing to come forth, while others are not so forward, the spinners are at a loss whether to let it come directly, or to kill the chrysalis to preserve the cocoon. If the rules which have been given, be exactly followed, this loss will be avoided, and the cocoons will be perfectly formed and ready to be reeled off at the end of seven days, reckoning from the day they first rose on the bushes or frames. By reeling off the cocoon between the period at which it is formed and that at which the moth pierces the cocoon to make its exit, the silk is of a much better quality and the necessity of killing the chrysalis is obviated. Spread the cocoons intended for seed, on a dry floor, and strip them clean of floss to prevent the feet of the moth being entangled in it when coming out.

The Seventh Age.

This age completes the entire life of the moth. When the *pupa aurelia*, or *chrysalis*, has completed its transformation in the cocoon and is ready to depart, it puts forth a liquid, some affirm an acid, to dissolve the gum; and having softened the point through which it intends to make a passage, it forces its beak through the fibres of the cocoon, and with two or three efforts, makes its exodus from its prison into open day. Sometime the moth does not injure the cocoon from winding; but it generally does so, and such cocoons are therefore, usually

set aside for floss, to be carded and spun like cotton. Sometimes the moth gets entangled in the fibres, or the cocoon is too hard for the feeble moth, and she deposits her eggs in the cocoon and dies there, or dies before this deposit. They should always be left alone to their own unasisted efforts. Nature will do more for them than art; and if a few should die, that few will be less than if the operation which some resort to of cutting open a way for them were resorted to.

At such times, the cocoons should be spread thin on tables; their natural mode is to put forth their heads and legs first, as they help themselves by laying hold on something with their feet and antennæ, to drag out the remainder of the body. They live, after leaving the cocoon, from five to twelve days, according to the temperature to which they are exposed. The moths do not come forth the first and second days; they are hatched chiefly the fourth, fifth, sixth and seventh days, according to the degree of heat in which they are kept. The hours in which the moths burst the cocoons in greatest number are the first three or four after sunrise, if the temperature is from sixty-four to sixty-six. The male moths, the very moment they come out, go eagerly in quest of the female. When they are united, they must be placed on sheets of newspapers or some such thing, so that when soiled they may be thrown away.

Preservation of the Eggs.

When the eggs have been deposited on dry cloths, and have passed through their several changes of color, the cloth or paper must be folded so as to admit air to them to prevent them from heating. The air should be dry, not above fifty degrees and not below zero. Some think they should not be exposed to frost, but this is an error; they have been repeatedly so exposed down to zero, and have subsequently been hatched producing an abundant crop. It is SUDDEN

CHANGES that affect the egg. Much has been said and written upon this subject by men professing great experience, certainly without having made an *experiment.* If the eggs can be kept between thirty-two and fifty-five, without injury from damp, they may be regarded as perfectly sound. They must be preserved from all insects, vermin and other enemies, since all insects, birds and vermin greedily devour them. *Good keeping will produce good worms. And if properly treated, they will never degenerate in this climate.*

STIFLING THE CHRYSALIDS.

Where the quantity of cocoons is small, the necessity of curing may be superseded by immediate reeling; or, if the culturist has on his premises an ice-house in which to deposit the cocoons, the necessity is obviated, as the chrysalis will remain in a passive state until brought to a temperature of from 40 to 50. This system is advisable where practicable; since stifling by baking and other processes is in some degree injurious. Otherwise, the moth must be destroyed between the fourth and twelfth day at furthest, after the completion of the cocoon; or it will cut its way through, and thus render the reeling of its work impracticable.

There are several methods of killing the pupa: 1st. *By baking* in an oven of the temperature of 88 or 89 degrees, wherein the cocoons are shut from four to six hours, after being first placed in bags, which must be occasionally turned or moved to effect an equal exposure. 2nd. *By the sun's rays* at a temperature of about 88, in which they may be left for three days, from 9 o'clock A. M., to 4 P. M. 3rd. *By steam.* For this purpose, place the cocoons in a basket lined with three or four folds of woolen cloth to promote the equal dispersion of the steam. Suffer the cocoons to remain in this basket of dimensions such as to cover the mouth of the kettle,

after the basket, raised on two pieces of intervening wood, has been placed over the kettle with water kept boiling over the fire. 4th. *By suffocation in the gas from charcoal*, which is effected by simply shutting the cocoons up for a night in a close room, wherein a pot of burning charcoal is placed. This process is said to be the least injurious.

PART II.

SERICULTURE.

THE SILKWORM—ITS EDUCATION AND REPRODUCTION.

ADDRESSED ESPECIALLY TO BEGINNERS IN THE SILK BUSINESS.

Written by FELIX GILLET, of Nevada City, California.

SILK raising is indeed, from beginning to end, a work so well suited to feminine fingers that in all countries where Silk is raised and manufactured, and from the most remote times to our days, that industry has been left almost entirely to the care of women. See what the Chinese legend says about the first efforts to make of that golden thread a tissue for us to wear: "This great prince, Hoang-ti, who reigned over China 2602 years before our era, was desirous that Si-Ling-Chi, his legitimate wife, should contribute to the happiness of his people. He charged her to examine the silkworms, and to test the practicability of using the thread. Si-Ling-Chi had a large quantity of these insects collected, which she fed herself, in a place prepared solely for that purpose, and discovered not only the means of raising them, but also the manner of reeling the Silk and of employing it to make garments."

"It is through gratitude for so great a benefit," adds the book entitled "Wai-Ki," "that posterity has deified Si-Ling-Chi, and rendered her particular honors under the name of the 'Goddess of Silkworms.'"

In the book "Li-Ki," which dwells on ceremonies and rites, and written by Khoung Seu, or Confucius, in the fifth century before Christ, we find the following: "During the last month of Spring, the empress, after having fasted and gone through the act of purifying herself, offers a sacrifice to the spirit, or 'Goddess of the Silkworms;' then she goes in the fields towards the rising sun, and gathers the Mulberry leaves with her own hands. She forbids the ladies of her suite and the wives of noblemen to wear any jewelry, and she exempts her waiting maids of any sewing or embroidery work, so that they may be able to give all their time to the raising of silkworms."

In the same work the author says: "By means of charms, are selected the ladies of the three palaces and the noble ladies that are pure and surrounded by happy presages, and they are then sent to the house of the silkworms, to feed them and to take care of them."

In the book "Chou-King," one of the classic books of China, we read: "On the first day of the moon, in the first month of Spring (March), the prince's wife takes the silkworm grain to the river, where she gives it a cold bath."

In the work entitled "Nong-Sang-Thong-Kioue," (year 48 B. C.), we see: "The mother of the Emperor Youen-Ti used to visit the house of the silkworms, and, accompanied by the empress and the ladies of her court, she would pick leaves on the mulberry trees for feeding the worms."

Under the Song dynasty (same work, and between the years 454 and 457, A. D.), the Emperor Hiao-Wou-ti had a silkworm's house constructed; the empress herself was gathering the mulberry leaves, after the rites of the Tsin dynasty."

The Chinese author keeps on citing numberless facts of that

kind, taken from the history of the succeeding emperors down to the years 968 and 976 of the Song dynasty, under which he was living, and in this way trying to show the mass of the people that from the most remote epoch to his time, the empress, to give the example to the whole empire, and foster that noble industry, would herself raise silkworms.

I have taken the pains of giving the public those few extracts of Chinese authors because, in that country, silkworms have been raised from time immemorial, the work being done almost exclusively by women, and that industry, having ever since been carried on successfully, adding immensely to the prosperity of China and to the happiness of her people.

Now I would add a word of encouragement to the women who are using their best efforts towards founding silk culture on this side of this continent, so eminently adapted for it, and in a way that will give unlimited employment to thousands of women and children. Keep on with your noble work; do not be discouraged by difficulties that may meet you in the prosecution of the work. Do not expect too much in the beginning—"great trees from little acorns grow;" rely on yourselves, and try your hand at the new industry, the raising of silk. Giving all that precedes this as an introduction to my subject, I will now describe

The Art of Raising Silkworms

In as clear and efficient a manner as an experience of fifteen years in the business, and a thorough study of the question will permit. But as this paper is written expressly to the address of people totally ignorant in the business, people of small means, and who cannot raise silkworms but on a small scale, I will beg more enlightened persons in that art to take this into consideration in perusing these letters, and not look them through for such information on the carrying on of the business on a larger scale, as would necessitate on the part of the writer a more elaborate and lengthy paper.

I will first, for the better understanding of the business by inexperienced people, give them some explanations of terms commonly and universally used in silk culture:—

Sericulture.—Silk culture; the art of raising silkworms; from the Greek word *serikon*, silk: *sericum*, in Latin.

Sericulturist.—A silk grower; a person who raises silkworms.

Cocoonery.—A magnanerie; a house in which the worms are reared or raised. No matter how small or large is the house or room where silkworms are raised, it is a "cocoonery."

Education.—The act of educating or breeding or rearing silkworms. A term of general use in silk-growing countries. Examples: the education is getting along finely; the education commenced on the 15th day of April and ended on the 1st of June. The education of silkworms comprises the feeding and treatment of the worm, from its birth to the formation of the cocoon.

Annuals.—Races of silkworms that breed but once a year. Yield the finest and largest quantity of silk, everything being equal. Annual races.

Bivoltine.—A race of silkworms that breeds twice during the year.

Polyvoltine.—A race of silkworms that have several broods a year. The silk of Bivoltine and Polyvoltine races is inferior to that of Annuals, yielding a great deal less, and in this proportion: Twelve pounds of Annual cocoons will yield one pound of raw silk, while it requires from 18 to 25 pounds of Bivoltine or Polyvoltine cocoons to yield a pound of silk.* For that reason such cocoons sell so much per cent. cheaper than Annuals.

Litter.—The accumulation on the paper or frame where the worms lay, of debris of dried and partly consumed leaves, and of the offal of the worms themselves. Thanks to our very dry

* This weight applies to fresh cocoons before they loose weight by choking.

atmosphere, the litter has not to be thrown out so often in California as in other silk-growing countries, where the atmosphere is quite damp; though it is of the greatest importance to keep the worms in as clean a condition as possible.

Shifting.—It is a very simple operation, done either for taking away the litter and spreading out or thinning out the worms. It is done through muslin or gauze for the first two* ages, and perforated paper, or leaves, or little twigs, for the last three ages. As soon as the muslin, or perforated paper, or twigs, are loaded with the worms, they are shifted or removed to another shelf or tray. For spreading out the worms, the operation has to be done in two different, but successive, times; or else two pieces of muslin or perforated paper have to be laid upon the worms in such a way that each muslin or paper will hold half of the worms to be shifted and spread out. As soon as the muslin or perforated paper is laid upon the worms, some leaves have to be spread over muslin or paper, so as to induce the worms to climb up through the holes of the muslin or paper to the fresh leaves above. The worms of one paper are thus spread out on two papers, occupying double the space they did before the shifting operation took place. A little practice will soon accustom any of our bright children with this delicate but easy operation.

Shelves.—Trays or hurdles composed of boards (an inch to half an inch in thickness), or of laths nailed sideways on cross-pieces, and forming a kind of lattice-work. These shelves in regular cocooneries measure five feet and four inches by twenty-six inches. They are placed on cross-pieces fastened to upright standards, and at a distsnce of two feet from the floor, and sixteen inches from each other, making four tiers of shelves in a room, with a ten to an eleven foot ceiling. The upright standards are placed four feet four inches apart, twice the width of a single shelf, so as to allow a double set of

* Mosquito netting preferable for the first stages.

shelves, the worms being thus fed from each side. A narrow room may contain only a double set of shelves right in the centre of the rooms; if wide enough, it may contain either a double set of shelves in the middle and a single set on each side, with a passage all round, or else two double sets of shelves with a passage on each side.

Moulting.—The time at which the worms accomplish their changes. When ready to moult, they first fasten their hind legs to anything they find on or round the litter, then cease to eat and after having gone through that moulting sleep, which lasts twenty-four to thirty-six hours, they cast off their old skins. There are four moultings.

Ages.—Period between two moultings or changes. Silkworms moulting four times have, therefore five ages. If raised at a high temperature (between 80° and 85° Fahr.), and fed constantly day and night every four or five hours, silkworms will live thirty-two days from the day of hatching to the spinning of cocoons—the first age lasting five days; the second, four days; the third, six days; the fourth, seven days; the fifth, ten days.

Freze.—The time of great greediness of the silkworms; it comes on between the fifth and eighth day of the fifth age. It is well to give the worms during that freze time some extra meals, or, in other words, to feed them more frequently.

Chrysalis.—The form assumed by the worm inside the cocoon after being done spinning, and preparatory to issuing a moth or perfect insect.

Twin or Double Cocoons.—They are easily recognized by their extra size and firmness; they have from two to several chrysalides inside. The silk obtained from such cocoons by carding, for they cannot very well be reeled, is called Doup-pions, and is mostly employed for the mannfacturing of sewing silk, cords, trimmings, and the like.

Stained, Softened, Pointed and Unfinished Cocoons.—As all

those names indicate, such cocoons are defective in some ways; they have, therefore, to be set in a lot by themselves when sorting the cocoons.

Grain.—Silkworm eggs.

Graining.—This comprises the selecting and coupling of the moths, the laying of the eggs; in a word, the general management of the eggs.

Cartoon.—Cardboard, paper or cloth nailed on a frame 14x10 inches, and on which the moths deposit their eggs. It holds an ounce of grain.

Filature.—A reeling establishment. The house where cocoons are reeled and turned into grege.

Basin.—A hollow vessel made out of copper, brass, iron or terra cotta; semi-spheric, of a depth of three to six inches, wih a rather flat bottom and smooth surface. Basins are used to dissolve the gummy substance that makes the silk of the cocoon stick together. By throwing cocoons into the heated water of the basin, and by stirring up with a little broom the threads are caught and reeled out; from five to seven cocoons according to the fineness of the silk, are thus reeled into one thread.

Gloss Silk.—The loose silk that envelops cocoons; it is carded and spun like cotten or wool.

Grege.—Raw Silk; the Silk as it is reeled from the cocoons.

Tram.—Shute or woof; two or three threads of raw Silk or grege twisted loosely two or four times to the inch. In weaving, the woof has little or no strain upon it, and it fills up the warp better by being soft and loose.

Organzine.—Thrown silk; its organizes are the warps of woven goods; they have to receive tight twisting to induce strength and elasticity; hence the finer and more regular threads are taken for making organzines.

Keeping the Grain, and Hatching the Same.

Presuming that persons intending to raise silkworms have procured in advance, and through the winter, the requisite quantity of grain, I will first say a few words in regard to preserving the same. The best place in which to keep silkworm grain during the winter is in a room overlooking to the north, and where the temperature never arises above 50 degrees. By the 1st of March, or sooner, according to localities, or as soon as the temperature of the room where the grain has been kept arises above 50 degrees, the grain has to be removed to a cooler place, say to a dry cellar, and out of the reach of rats, mice, spiders and ants. Should the cellar be somewhat damp, the grain then would have to be taken out once a week and exposed for two hours, and in the shade, to the cool air of the morning, freezing or very cool weather being preferable. Silkworm grain is not affected at all by moderate cold weather, like 15 to 20 degrees; on the contrary, it improves the grain considerably to expose it during the winter to the cold influence of the atmosphere.

Before going any further, I would like to impress upon the minds of our young or would-be sericulturists the importance of having the education finished before the usual hot spell in June. For, in California, even with her "splendid climate" and "wholesome food," a temperature at and above 88 degrees is as mortal or prejudicial to the worms as it is in any other country where silkworms are raised; for such maladies as jaundice and grasserie will surely break out among the worms wherever the temperature of the cocoonery is increased to that degree. It is, therefore, of the first importance to commence hatching as soon as the swollen buds of the mulberry are bursting open, throwing out their first leaves. The success of the whole education does, in fact, greatly depend upon a good and early start; this must be well borne in mind.

When hatching time is near at hand, and after having con-

sulted the condition of the buds on the mulberry trees in preference to the exact date given in treatises, the grain is taken out from the cellar and placed temporarily and for only a few days in any of the rooms of the house exposed to the south, to be finally removed to the kitchen. The kitchen, with the small Silk grower, may be in fact regarded as the hatching place *par excellence*. The grain is placed on a shelf or in a closet, out of the reach of mice, and at the farther end from the stove, to be taken by degrees and every day closer to the stove, though being kept at a proper distance from it. When having much grain on hand it is well to keep some in reserve in the cellar, in case of some accident happening to the grain put to hatch in the kitchen, or of a sudden frost killing the newly opened buds on the trees. The kitchen, besides being the best place where to hatch the grain, is also admirably adapted for raising the worms during the first, if not second, age, they taking but little room during those two ages. The worms that do appear on the first day are generally thrown away, on account of being so few; they may be called the forerunners of the hatching, and I would suggest to keep them, for by having such an advance on the worms hatched on the three succeeding days, they enable us to better tell when moulting time is coming with the other worms. Then they make the best grain, as being always the most healthy and vigorous worms of the whole lot. On the second, third and fourth day will the bulk of the worms be hatched, the balance of the grain may then be thrown away. All the worms hatched on the same day have to be kept apart and placed simply on papers, say half of a single sheet of newspaper or any paper that will hold them, with the date put down on the margin of the paper. It is very important to keep separate, during the whole education, worms of the same hatching, because of their changes or moultings, which are not accomplished at the same time.

The moment the young worms make their appearance, they at once look for food; so, very tender leaves have to be placed about the frame holding the eggs, and the little worms will soon crawl on them. When the leaves are thus well covered with worms, they are transferred with their precious loads to a paper duly marked 1st, 2d, 3d or 4th day, and there they are fed at the rate of four meals a day, say one meal every four hours commencing at about 7 o'clock in the morning.

Feeding the Worms.

After the worms are all hatched, the education may be regarded as fairly started. During that first age, which generally lasts five days, the worms have to be fed with tender leaves yet, such as the second and third ones of young sprouts; but any variety of mulberry will do as long as the leaves are tender, and it is mere nonsense to recommend at that early period of the insect's life this or that variety.

Alway cut up the leaves for feeding young worms,* and use a sharp, clean knife, being careful not to chop off with the leaves the tip of your fingers. During the first age the leaves have to be cut quite fine, less than 1/8 of an inch; during the second age from 1/8 to 1/6 of an inch, during the third age 1/4 of an inch; from the fourth age down to spinning time, they are served entire, unless too large; in that case the leaves are cut from 1/2 of an inch to one inch. The object of cutting up the leaves is to enable the educator to scatter them evenly so that each worm will be sure to have its proportion of food; then by feeding the worms equally, they grow equally, too, and accomplish their various moultings at the very same time, which is a most important point, saving thereby a great deal of labor and trouble; and it cannot be impressed to much upon the minds of our beginners. On the fifth day of that first age, the little worms have to be closely watched; an ex-

* The cutting of the leaves for young worms is very important.

perienced eye will see at a glance whether they are ready or not to "sleep," preparatory to casting off their skins. When the worms are ready for that moulting sleep, they cease eating, keep still, and over their little black head appears a spot like a half moon, the new head; this is the most remarkable feature to announce that the worms are going through that moulting sleep. While undergoing that change, they must not be fed at all; it does not matter whether some of the worms are not ready for it yet. The newly moulted worms must not be given a first meal before all the worms are done with shedding their skins. The worms must not be thinned or spread out, or the litter thrown out—shifted, in a word—when they are getting ready for their moulting sleep; and it must not be done, either, right after they are done moulting, but next day. All those little points have their importance, as a season's experience will show to any of our young sericulturists. All that is said for this first age of the insect's life in regard to moulting, applies with equal force to the other four ages.

No wet or damp leaves must be given to the worms; if rainy, the leaves may be gathered right in the morning and put to dry on the floor of the cocoonery; if too wet yet when meal time comes on, they must be dried gently with a cloth, before giving them to the worms. Otherwise it would certainly be better to give the worms on such a rainy day two meals with dried leaves than four meals with wet leaves. It must also be borne in mind that cleanliness, regularity in the meals, evenness in feeding are most essential points to bring the education to a successful close. It will take about forty days for worms fed four times a day at four hours' intervals, and at an average temperature, to be ready to spin their cocoons; it will take less time if the meals are more frequent, and if the worms are fed night and day. A silkworm having to absorb from hatching to spinning time a given quantity of

leaves, whether he absorbs it in 32, 40 or 50 days, it is immaterial, but he must have consumed that quantity of leaves to spin a cocoon. Four meals a day, however, commencing at 7 o'clock in the morning, come right so as not to hinder the farmer's wife, who is supposed to superintend the education, with her daily occupations, like dinner and supper, on the farm. By commencing at 7 o'clock, the worms have thus to be fed next at 11 o'clock, then at 3 o'clock, and 7 o'clock in the evening. At that time of the year work crowds up a good deal on a farm, hence the education of silkworms must be made as light as possible.

Spinning Cocoons.

When arrived at maturity, the worm ceases to eat, gets smaller, becomes transparent, and of a pale yellow, and finally gives out its silk, which it spreads out here and there, raising up its head at the same time, as if to reach something. All this means that spinning time has come; and as soon as some of the worms give such signs and wander about in search of some nook or corner wherein to spin their cocoons, then has the time come, too, to provide them with a place where to build their precious little nests. In regular cocooneries, they use shelves made of strips of wood one-fourth of an inch by five-eighths of an inch, nailed one and one-eighth inches apart, sideways, on cross pieces five-eighths of an inch square; and on the other side, the same number of strips are nailed, in the same manner, on the cross pieces, but so as to correspond with the center of the space between two strips of the first side, thus forming a triangle inside the strips of the shelf with two sides one inch and one-half long, and the third side one inch and one-eighth; that is what is called "cocooning shelves." They are the most handy and neat things of that kind ever invented. The silkworm finding in that triangle composed of three strips, three standings, just what it wants to spin its cocoon, goes to work at once, without wasting any

more silk. Ladders, called "cocooning ladders," are made on the same principle; they are put in place every fourteen inches, as soon as the worms are getting ready to spin, and fastened with a little screw or a peg to the strip set at the edge of the shelves, to prevent the worms from falling off the shelves. The worms climb up the ladder to the upper shelf, into the racks of which they spin their cocoons. Some of the worms, weak or lazy, spin right into the racks of the ladder. But with our beginners and small silk growers, who use simply boards for shelves, something else has to be resorted to. Sheaves of straw, wild mustard cut before the seed is ripe, boughs of willow, twigs of white oak with the leaves on and dried in the shade, bunches of wheat or rye straw, etc., can very well be used, but they have to be kept in readiness a couple of weeks before spinning time.

It will take four days for a silkworm to finish its cocoon, and another three days to pass into the chrysalis state. So they must not be gathered before eight days, and not before twelve to fourteen days, if the cocoons are destined for graining. If to be sold for the silk, cocoons may be gathered on the ninth day after the last worm has gone up to spin; and by exposing them for three or four days to the sun, the chrysalis will be killed and pretty well dried up, and unable to stain or injure the silk with the putrid matter of their decayed bodies. Cocoons, when having to be kept a certain length of time before being sold, have to be stored away out of reach of mice and rats, and of moths, too, which would perforate the cocoons with their larvæ.

Graining.

This is the last and not the less important stage of the whole education. For the purpose of graining, either for market or merely to save eggs for the reproduction of the worms, the cocoons have to be carefully selected. The best cocoons are those that are hard to the touch, depressed on the middle—

that is, pea-nut shaped—firm at each end, of a light yellow color, and of a rather coarse grain—that is, to the eye. If, besides, the cocoons are large, so much the better; otherwise, smaller cocoons with the above requisites would be preferable. The floss, or loose silk, having been properly stripped from the cocoons, they are then placed in hollow boxes of any size, about three tiers in each box, and in a room where nothing may disturb or injure the chrysalis soon ready to emerge from the cocoon as perfect insects; fifteen to twenty days, according to the weather, after the cocoons have been commenced, do the moths emerge out from their temporary tomb. They always come out of the cocoons early in the morning, just after sunrise, between six and eight o'clock. The male, which is more active than the female, seeks at once the latter for the purpose of reproduction. As soon as paired, they are taken by their wings to sheets of paper spread on some of the shelves for that purpose; and those that are not paired are laid aside by themselves on another paper and removed by the others as soon as paired. They have to be coupled the whole day, when between four and five o'clock in the evening they have to be gently separated. The males are put temporarily in a box with the cover punctured so as to admit air; they acting as a reserve for next morning in case of more females than males hatching out. The females, after being separated, are removed to a cloth nailed to the wall, where very soon they will deposit their eggs. Cloth is preferable to paper, for the eggs laid on cloth can be given a cold bath in February or March, and the grain might be taken off, if desired, by dipping the cloth in cold water and scraping off the eggs with a table knife. The sound eggs will sink at once to the bottom of the vessel used for that purpose, while the bad ones will float over the water and be easily separated from the good eggs, which are put on a cloth to dry right in the room.

The eggs laid just after separating the sexes are considered

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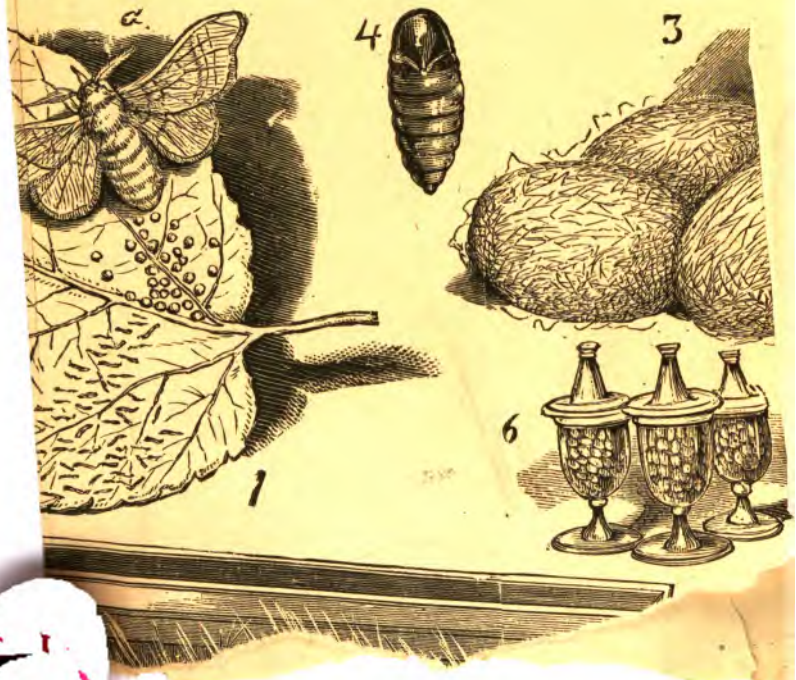
MODE OF PRODUCING SILK.



mulberry must not be planted on the land best suited for the poplar; and on hill-sides and poor land the mulberry will yield the best and healthiest leaves.

The leaves of the mulberry must be free of dust when served to the worms; and when too dry, as is sometimes the case with some varieties in summer, it is well to sprinkle them slightly with water.

Let it be well borne in mind that silkworms will succeed best in those light structures made of wood or still lighter material, in the cane and bamboo shanties of China and Japan, in the cabins of the Egyptians, in the open sheds of the Persians, in the kitchens, hardly closed and smoky, of the French and Italian peasant, than in comfortable houses or costly cocooneries furnished with the latest modern improvements.

A good start is of the very first importance; to have a good start, one must have good grain. Good grain is the corner stone of a good education. The best grain is that obtained from moths issued from the first cocoons spun, or from the first moths hatched and those that are hatched between 3 and 7 o'clock in the morning.

The healthiest worms are those first hatched. Always cut up the leaves during the first three ages, from very fine to fine, and from fine to coarse, keeping up with the worms' growth. After the worms have been fed for two days after hatching, the cut leaf that has not been consumed will make as many little hills, upon which the worms lie too close together, and as they must never be allowed to crowd up, the litter has to be carefully spread out, with the worms on it, so as to give the latter more space. This is done at meal times, for the worms have to be fed immediately after the operation, cut leaves being made to fill up the interstices between the scattered litter. This operation is repeated at the other ages whenever needed. Never keep the worms too crowded or thick together on the papers. After the fourth moulting one square foot must be

allowed to every hundred worms (but at that age the worms occupy the whole space upon the shelves), overcrowding being liable to create disease.

Having once put the worms on hard food, that is, upon well-matured leaves, the use of young and tender leaves must never be reverted to again.

Silkworms are more in dread of hot weather than cold weather; if properly fed they can stand very severe cold weather. When it is cold, however, the silkworm has less appetite, three, or even two, meals a day would be sufficient; though the education will last so much longer. Never forget to remove worms of doubtful health.

Give to the worms the freest possible ventilation. Silkworms do not relish the sun's rays; but air that gets into the room through crevices will never create disease among them. For, if the precious insect has need of a sort of shelter, particularly in its young age, it must not be an "air extinguisher." In China, at the Fall of the year, and before the Mulberry leaves turn yellow on the trees, a certain quantity of them is gathered, dried in the shade and pulverized. They are then preserved in a very dry room, where fire is generally kept during the winter. They are used the ensuing year as food for the worms, as follows: "After each moulting, and for four or five meals, the flour of pulverized leaves is evenly sifted upon the fresh leaves, which have been previously lightly sprinkled with water and served to the worms. It feeds the latter well and helps them to spin a heavy cocoon whose Silk thus acquires a remarkable strength and elasticity. If heating the silkworms' room when too cold and damp in the spring is required, it ought to be done at the time the worms are fed, the fire being allowed to go out after they are done eating.—Chinese precept.

Right after hatching, the worms weigh $\frac{2}{3}$ of the weight of the egg, leaving $\frac{1}{3}$ of the whole weight for the shell.

Japanese eggs weigh ⅓ less than annuals. Thirty grams or a metric ounce (the American ounce is 28 grams) of French and Italian animals grain, contains 42,000 eggs, while the same quantity of Japanese grain contains 60,000 eggs.

The worms that hatch from 30 grams of grain, will consume during the 1st age, 8 pounds of leaves; 2d age, 24; 3d age, 55; 4th age, 243; 5th age, 1,335 to 3,350 pounds. It is, therefore, well to reckon upon an average of 2,335 pounds of leaves for 30 grams of grain.

For the same quantity of grain, the worms give during their life-time almost 500 pounds of offal, which constitutes the best manure for Mulberry trees.

The thread of a fine French annual cocoon will measure as much as 1,350 yards. Two hundred and thirty-four of first quality French or Italian annual cocoons, will weigh, fresh, before killing the chrysalis, one pound; while it requires 342 Japanese annual cocoons to weigh that much. When diseases rage among the silkworms, it requires twice as many cocoons, so little Silk do they produce.

Perforated or pierced cocoons lose 80 per cent. of their weight; the chrysalis, thus, weighs four times as much as the silky envelop, or cocoon proper.

Four pounds of Japanese green cocoons will give about one pound of dried cocoons.

Female worms, cocoons, and moths, weigh ten per cent. more than males. Before the epidemics that have been raging for over thirty years, cocoons did yield one-tenth of their weight in Silk of first quality; twelve pounds of second class cocoons were required for one pound of silk. Nowadays, the best Japanese cocoons (the only kinds that can be raised in Europe with some profit, on account of the reigning epidemic) yield one-fifteenth of silk, and Polyvoltine races one twenty-fifth.

Bivoltine and Polyvoltine are easily transformed into Annual races, and *vice versa*. The best grain is that first laid.

The best female moth will lay from 400 to 700 eggs; 1,350 eggs weigh one twenty-eighth of an ounce; 37,800 eggs, an ounce; 618,800 eggs, one pound.

Good grain used to cost in France and Italy from forty to sixty cents per ounce, that is before pebrine and flacherie had broken out among the worms. Now, grain from Japan, the only country that can produce grain able to stand against the epidemic, sells at the rate of five dollars per ounce of twenty-five grains.

The production of silk in dollars, before the epidemic broke out in 1858, was reported as follows all over the world:—

Chinese Empire,	$81,000,000
Japanese Empire,	17,000,000
Corean Archipelago,	1,000,000
Turkistan (in China),	400,000
Turkistan (Independent),	1,400,000
Persia,	5,000,000
Asia Minor,	5,250,000
Syria,	1,900,000
Turkey in Europe,	7,000,000
Greece, Ionian Islands,	850,000
France,	29,900,000
Italy,	39,800,000
Pontifical States,	1,300,000
Spain and Portugal,	3,250,000
Morocco, Algeria, Tunis, Mediterranean coast,	300,000
Basin of the Danube, Austria, Bavaria, Servia, Hungary,	80,000
India,	24,000,000
America,	80,000
Total,	$219,510,000

Since that year, 1858, the production of silk in all the countries of Europe, in Asia Minor, Syria, and the whole Mediterranean coast, America, and some parts of Asia, on account of the epidemic, has fallen a great deal below the above figures.

Profit of Growing Silk.

How much money is there in it; or, in other words, how much could a small family expect by raising silkworms? That is the question—the main, fundamental requisite to make of this State a silk-growing country, par excellence. Will the business pay? For, though the climate may be exceptionally good, the food of the very best quality, still, if people cannot find in it remuneration enough for their labor and outlays—little as that may be—it would be useless, indeed, even to begin, and on a small scale, to raise silkworms. In former letters on this very subject, I have constantly warned our people, if they would avoid disappointment, against indulging in too fond and sanguine expectations regarding this silk business. I advocated then, as I always did, and still do, the raising of silkworms on a small scale; that is, household silk culture. I furthermore advised our silk-growers to give up the idea of making money by the sale of silkworm grain, for the very reason that California grain had been thoroughly tested in years past, and also found wanting; that is, unable, like all the rest, to stand against the present epidemic, flacherie, which to this day has baffled the skill of the most renowned scientists and sericulturists. I said it yesterday, I say it again to-day, I will repeat it to-morrow, in the hope that my feeble voice may be heard and my advice heeded by those people who are unknowingly deluding themselves in expectations that cannot be realized, and which I consider the duty of the better-informed people to dispel. I will therefore insist more earnestly than ever on the folly of raising silkworms in the hope of finding a ready market for the grain. Even supposing that such a market could be found, how long would that grain trade last? So I do assert, and without any fears of being contradicted, that the only consistent way of founding this silk industry in California, is to raise silkworms *solely for the*

silk. Let every one desirous of launching into the business be thoroughly impressed with the truth of that assertion.

Thus is the question simply narrowed to this: If raising silkworms for the Silk, how much can be expected from the sale of cocoons, and where shall we find a market for what we produce? But this is a double question. Where shall we find a market for our cocoons, is, however, the main question of the two; for whether we be more or less successful in raising silkworms, we must first have a market for our cocoons, with prices more or less remunerative, or else we had better give up the business, or never get into it. On the other hand, to get remunerative prices for the cocoons we would raise, we must certainly have a home market, cocoons being too bulky and too fragile a merchandise to be shipped away with profit to a distant market. Now, to have a home market for that class of goods, I maintain that we must have a "home filature," or reeling factory, where cocoons may be turned into grege, or raw silk; and, if an organzine mill be attached to it, have the silk thrown into organzine, for which there is an always ready market. Would people be satisfied with the prices given for their cocoons by such filatures, then would the problem be satisfactorily solved, provided that we would be "successful" in raising silkworms—that is, French annuals, the only paying kinds for us to raise; and I should not be over-confident on that point, either, considering the general failure all round with those fine races of silkworms since the epidemic broke out. The first steps to be taken, ought, it seems to me, to be toward the establishing of a filature in our midst; short of that, our efforts, I am afraid, will be almost futile. As a filature could not be self-supporting at the start, who will provide for its support till our farmers are ready to supply it with the raw material or cocoons? This is another question for all parties interested to determine. A filature of twenty bassins would require about 33,000 pounds of cocoons,

or the cocoons produced by 350 ounces of grain (French annuals). Supposing now that we could have a filature in our midst ready to buy our cocoons, the next question is: How much will they pay for a pound of fresh cocoons? how much for a pound of dried cocoons? Fresh cocoons would probably fetch from fifty to sixty-five cents per pound, or 260 cocoons of the French annual races, healthy, sound, firm cocoons, as are hardly raised anywhere nowadays, always on account of that everlasting epidemic, which, if it does not sweep away the worms, at least renders them weak and unable to spin heavy cocoons; so much so, that it will be wiser to reckon on 400 cocoons to the pound. Dried cocoons would fetch in the proportion of one to four; that is four times as much as fresh cocoons, since cocoons lose by drying eighty per cent. of their weight; or from $2.00 to $2.50 per pound (1.050 to 1,600 cocoons).

Pierced cocoons, if quite clean, will fetch $1.25 to $1.50 per pound for carding, right at the factory, not at the shipping place.

A farmer's family may raise, according to its size and that of the room alloted to silkworms, from ten to twenty thousand worms; or, if the education would be quite successful, from 30 to 70 pounds of fresh cocoons, which at the average rate of 60 cents, would fetch from $18 to $42. I do not mean to say that a farmer's family could not raise more than that; I have only reference to the average farmer. If, having a room large enough for that purpose, a farmer's family may, of course, raise easily from 50,000 to 75,000 worms, including the gathering of the leaves. The above figures show that I was right in my first estimates in putting down at from $10 to $100 what any farmer's family could reasonably expect by raising silkworms.

Conclusion.

In this paper on the silkworm, how to succeed in founding

upon this coast that beautiful industry, and what we have to expect from this business, new to so many of us, I have told the people, and in very plain language, too, all the truth about it. Let nobody think for a moment that I have been grinding it too fine. By following my advice, none will have to regret it; none will experience that bitter disappointment and loss of money, as will surely be the case if going at it blindly, planting acres of Mulberry trees, raising silkworms in large quantities, launching into the grain business—in a word, deluding oneself.

To all those beginners that have not the least knowledge, or very little, in the art of raising silkworms, I say, go at it slowly, feel your way first, plant only, for a start, a few Mulberry trees, and plant them where they may be an ornament to your place, or where they will never be in the way afterward, in case that you would make up your mind not to raise any more silkworms. Commence by raising but a few worms, say from one hundred to two hundred; learn, first, all those little things about silkworms that cannot be properly learned but by a little practice, and as soon as you have acquired an inside knowledge of the business, then it will be time for you to increase the quantity of grain to hatch and worms to raise, but only as far as your means will allow, never going any farther. And if by going into the business little by little, you finally come to the conclusion that it does not pay you for all your trouble, you will have then the satisfaction of having incurred no loss of money to speak of, or, what is better, not experienced that bitter disappointment concerning your most fond, but unrealizable expectations.

PART III.

DIRECTIONS FOR THE MANAGEMENT OF A COCOONERY.

By W. C. Kerr, State Geologist, North Carolina.

I. Hatching.

THE eggs are usually kept at the temperature of ice until hatching time. When removed from the ice, put in a cool place two or three days, so that they may be brought gradually to the temperature of the air. As soon as the Mulberry leaves have begun to open, spread the eggs on clean white paper; an ounce will require a square foot of surface. The temperature should be about 70°, and may be gradually increased 1° or 2° a day, to 75° or 80°. They will hatch usually in five days, but the higher the temperature the sooner the hatching. The worms will commonly hatch out in the morning, for three or four successive days. When the hatching begins, spread over them mosquito netting or perforated paper, and when the morning's hatch has crawled through, remove to the (frame, or) platform, marking, and keeping each day's hatch separate. Better use the net for the first age, and the paper afterwards.

II. Feeding.

The worms should be fed as soon as hatched and removed, by sprinkling young and tender leaves over the net or paper; repeat the feeding every two hours during the first age, and afterwards every three or four hours. In general, give the first feed at five o'clock in the morning and the last at ten or eleven at night. Before each feeding spread a net or paper over the worms and place the leaves on it. About every two days, lift the net with the worms to a new frame and remove the litter. The space must be increased as the worms grow, so as to avoid crowding. They will need double space the second day. To accomplish this, in feeding, when about half the worms have come through the net or paper, remove, and place a second paper with leaves for the remainder; in the same way the space may be trebled by removing one-third at a time. The leaves should be spread evenly, so that the worms may get the same amount of food and keep together in their growth, as it is important to have them moult together.

The leaves must be fed *fresh and dry, never wet or wilted;* leaves wet with dew are especially injurious. Gather the leaves in the evening, for the next morning's meal, and when rain threatens, gather a day ahead and keep in an airy, cool place, stirring occasionally to prevent heating and fermentation, which will ruin them. If only wet leaves can be had, dry them by shaking up before a fire, or in a breezy place. When food is scarce, lower the temperature of the room, and the worms will eat less.

For young worms, gather only the small leaves. After the second age, small twigs, or branches, may be cut with the leaves. For this purpose use a knife, or better, clip with pruning shears. Gather in a basket, or better, in a bag tied about the waist.

The quantity of food consumed increases very rapidly. The worms are said to consume their own weight of leaves daily.

The worms from an ounce of eggs will require about one pound of leaves the first day, two pounds the second, three or four the third; after that the quantity diminishes as the time of molting approaches.

After the second or third age, the net (or paper) and frame may be discarded, and the leavy twigs or branches with the worms, may be placed on the platforms directly. The successive feedings of twigs are spread evenly on the old ones until the mass is piled up four or five inches to the next tier of pins or nails, then lay a new set of five bars or sticks, with the food on these, and when the worms have ascended, drop out the lower tier with its litter and remove.

In using a second or third tier over the first, as C, C, C, C, Fig. 1, (*page 97*,) it is necessary to place beneath, on a couple of bars, B, B, B, B, cloth or boards to catch the leaves and litter from above.

The utmost cleanliness being necessary, the litter should be removed often, especially during the last three ages, as well as all dead and sick worms. The consumption of food is enormous during this age, the hatch from an ounce of eggs requiring about fifty pounds the first day, and by the fourth one hundred and fifty, and double that amount the fifth, sixth and seventh, after which the quantity falls to about one hundred pounds for the eighth day, but the quantity depends on the vigor of the worms, and the temperature.

During this last age the closest attention is necessary and the amount of labor is greatly increased. During the earlier ages a woman, or half-grown child can attend to the worms, and a man or boy in one or two hours, two or three times a day, can supply the leaves required for the worms from an ounce of eggs; and even during the last age, one person is sufficient in the cocoonery, and one to gather the leaves for the hatch of half-a-dozen ounces of eggs or more, with the apparatus above described.

III. Moulting.

When the time for their sleep approaches, the worms lose appetite and raise their heads with a waving motion. When any of the worms of a batch are seen in this state, give a light fresh feed to hurry up the tardy ones. During their torpor they eat nothing. As soon as their skin is shed their activity and appetite return. This process is usually over in about thirty hours. No food should be given until about all of the batch are through the moult and ready to make an even start; or, if the last are much delayed, give a light feed to the first, and feed the last more copiously, and keep them warmer for a day or so, that they may overtake the first. This rule need not be observed after the fourth moult.

After moulting, the space will generally need to be doubled. If the worms come out of their torpor in a feeble state, with little appetite, especially in the younger ages, cut the leaves for the first feed or two with a sharp clean knife, like shredded tobacco.

IV. Spinning.

When ready to spin, which is eight or ten days after the fourth moult, the worms cease to eat, become restless and empty themselves, diminish in size, becoming transparent, beginning at the head. When any of them are observed in this stage, give a light fresh feed to bring forward the laggards. And as soon as they begin to emit silky fibre, take the frames, Fig. 2, (*page 98*,) that were used to hold the young worms, tie together two and two, bottom to top, set upright on their edges, a, a, a, or b, b, b, with the slats of one opposite the intervals of the other, upon the platforms, among the worms. They will use these as ladders and crawl up between the slats to spin. Or instead of these, dry branching twigs, two or three feet long, or broom corn or weeds may be used, setting them upright among the worms, and inter-locking them in arches above. If any of

the worms fail to mount, remove them on the leaves or twigs to which they are attached, lest they be soiled by droppings from above them.

The spinning is finished in three days. As the worms begin to spin, see that no two of them spin too near each other and make double cocoons, which cannot be reeled.

To sum up, the points requiring special attention are:

1. Keeping the worms of a batch in a uniform state of progress so that they will all moult together. 2. Abundance of fresh, dry food, except during the moult. 3. Plenty of room, so that the worms shall not crowd each other. 4. Plenty of fresh air. 5. Uniform temperature, as nearly as practicable, and avoidance of sudden changes. 6. The utmost cleanliness.

V. Gathering and Sorting the Cocoons.

In eight or ten days after the commencement of the spinning, the cocoons are ready to gather. Separate the frames or arches of brush carefully. Remove first all discolored and soft cocoons, keeping these seperate from the firm sound ones; if kept together the latter would be discolored and depreciated much in value. Tear off the loose (floss) silk which envelopes the cocoon.

VI. Choking, or Stifling the Chrysalids.

In twelve or fifteen days from the time the worm began to spin, the moth will issue from the cocoon, and in the process the strands of Silk will be cut and spoiled. To prevent this, the chrysalis must be killed—*stifled.* This is commonly and best accomplished by steaming; but as that is troblesome, and difficult without proper appliances, in our climate the stifling may usually be effected by exposing the cocoons to the hot sunshine from 9 o'clock till 4, for two or three days. A longer time is needed if there is much air stirring, or the sunshine is not strong. And the process is surer if conducted

GENERAL INFORMATION.

I. The Silkworm.

1. *The Egg.*—An ounce of eggs contains 40,000, and this number of worms will produce 100 to 120 pounds of fresh cocoons (or one-third of that weight of dry.) An ounce (or even a quarter of an ounce) is sufficient for a beginner for an experiment. They are readily sent by mail. The cost is about five dollars an ounce.

2. *Ages.*—The silk caterpillar casts its skin four times, at intervals of 5, 4, 6, 6 and 8 days, after a short sleep or rest; this change of skin is called *moulting*, and the interval between two moults an *age;* the life of a worm, from hatching to spinning, is about thirty days, a few days more or less, according to the decrease or increase of temperature and supply of food.

On the approach of the sleep or torpor, the worm ceases to eat, and becomes motionless, with raised head.

II. Food.

The silkworm eats and thrives on a great variety of food; the leaves of the lettuce, common (or black) mulberry, the osage orange, etc., but the white (often miscalled "English") mulbery furnishes the best silk.

III. Room.

Any sort of house or room may be used as a *cocoonery*, for hatching and raising silkworms, provided it is well-lighted, well-aired, and can be kept tolerably uniform in temperature by a stove; fire will be needed on cool nights and rainy days. Direct sunshine should be excluded, which may be done by tacking white paper or cloth over the sash on the sunny sides of the room. For a small crop, a room on

the north side of the house is better, for avoiding excessive heat. Ventilation should be secured from the upper part of the room, to avoid direct drafts upon the worms. A close hot air is injurious, and any sudden or great change of temperature. Cleanliness is very important. Rats and ants must be excluded, as they are very fond of the silkworm larva. *The odor of smoke and tobacco are fatal.*

IV. Apparatus.

Both room and apparatus should be arranged to secure, as nearly as may be, the same conditions which the worm finds on the tree. Any frame, or platform, or structure, therefore, which will allow the freest circulation of air, *from below*, as well as on all sides, and the ready removal of litter and stale leaves, will answer. Perhaps the best appliance in use for this purpose is that represented by the accompanying diagram, Figure 1. For information about this improvement I am indebted to Mr. E. Fasnach. It has been recently adopted extensively in France, from the Italian silk culturists of a little province (Frioul) on the North Adriatic near Trieste. To the floor and ceiling (or joists) are fastened a succession of parallel sets of five uprights, bars or sticks (which be 1½, 2

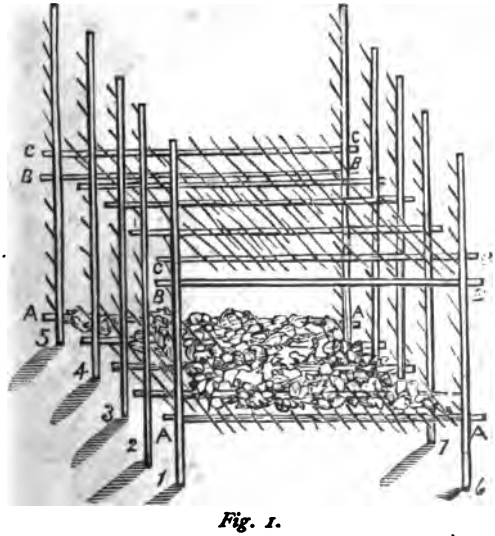


Fig. 1.

or 3 inches thick); two of these sets are represented as touching the floor at 1, 2, 3, 4, 5 and 6, 7, etc. The uprights are about one foot apart in the sets, and the sets running the length of the room, about five feet apart, and the whole should be not less than two feet from the wall. The uprights have sloping pins or nails driven into them 4½ or 5 inches apart. On these, as at A, A, A, A, and C, C, C, C, are laid a series of five bars or sticks, and across these little rods or straight twigs; the first of these platforms may be five or six inches from the floor, and the next, C, C, C, C, say two or three feet above that, and so on, as high as one chooses to go; but two are as many as can be easily managed without steps. On these platforms are placed the papers or frames containing the young worms, up to the third (or fourth) age, and after that the twigs or small branches of mulberry leaves with the worms. Note that all the timber of both room and apparatus must be *seasoned.*

The papers containing the young worms may be laid on these platforms directly, but it is perhaps better to use frames like that represented in Fig. 2. The bars A A and B B are three-quarters of an inch thick, the cross slats or laths, *a b*, are half an inch thick, an inch (or less) wide, and an inch apart. It is better to make these frames two and a half feet by five, so that two of them will occupy, crosswise, one platform of Fig. 1.

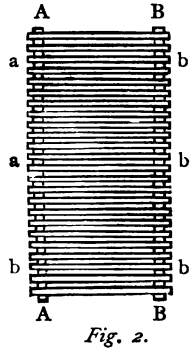


Fig. 2.

The only additional apparatus needed is perforated paper, as seen in Fig. 3, and netting (mosquito or other) about the size of the frames, for the younger stages of the worms.

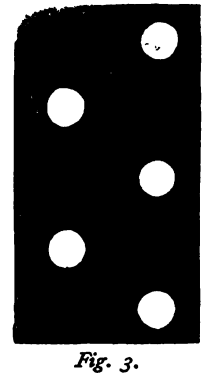


Fig. 3.

The paper should have some strength and stiffness, so that it can be lifted with the worms on it without huddling them. A good quality of merchants' wrapping paper will do. The perforations of the size and distance apart shown in Fig. 3, may be made rapidly by a common belt punch, by folding the paper ten or a dozen thicknesses.

V. The Mulberry.

The white mulberry is easily propagated. It flourishes best in light sandy or gravelly soils. One full-grown tree will yield 200 to 300 pounds of leaves. Two hundred trees may be planted on an acre of land. In three years they will yield, under fair conditions of soil and cultivation, ten to twelve pounds of leaves each, or more than two thousand pounds to the acre. Eighteen hundred pounds suffice for an ounce of eggs; that is, will produce 100 to 120 pounds of fresh cocoons. At seven or eight years the yield will be ten fold. Trees suitable for transplanting and cuttings, can be had from The Women's Silk Culture Association, and also from many nurseries.

PART IV.

REARING THE SILKWORM.

THOSE who wish to engage in the culture of silk, though not extensively, need not incur the expense of building a cocoonery. The worms may be fed in a shed, barn, outhouse, or any place where they will be protected from the sun and rain. A free circulation of air, and entire cleanliness in their apartments, are absolutely requisite. They will not prosper near to decomposing animal or vegetable bodies, nor in an atmosphere rendered impure by any cause whatever; and the smoke of tobacco is peculiarly offensive to them. The wood-cut in this number (*page 110*) represents the internal arrangements of our cocoonery, and by a glance at it, the reader may obtain a better knowledge of its structure and fixtures, than from any written description which could be given. We are not advised that any more convenient edifice has anywhere been constructed for the purpose to which it is applied. It is 100 feet long by 30 feet wide, and two stories high, with large sliding windows on both sides, and at each end sufficiently capacious to contain four rows of shelves in each story, having plenty of room to pass between them to change the hurdles, etc. There are five shelves in each row, as represented in the wood cut, three feet in width, four in length, and fourteen inches apart. Two millions of worms may be reared in a building of this size and construction.

The proper time to hatch the eggs of the silkworm depends somewhat on the state of the foliage of the mulberry tree. It is soon enough when the weather becomes regularly warm, and when the leaf of the tree has attained to a considerable size. Spread the eggs thin on paper in a warm room, when the temperature is at 70° or 75° Fahr. The room must be well lighted, but the sun should not shine directly upon the eggs. In six or seven days the worms will appear, and must be removed to the shelves, where they are to be fed. A little food now suffices, and that little they must constantly have. The leaves should be cut fine before they are given to the worms. The life of the worm is divided into five ages, and these ages are marked by four intervening moultings. During these moultings no food should be given them, but unusual pains be taken to keep the air salubrious throughout the cocoonery. When litter begins to accumulate, it must be removed. The old method of effecting this was to place some leaves on one side of the shelf, and when the worms had crawled to and begun to feed on them, that side of the shelf which they had left was brushed, then again the leaves and worms, together, were removed to the place where the filth had been taken away, and both sides of the shelf were thus made clean. When many worms were fed, this portion of the labor was tedious and disagreeable, and not very conducive to the health and growth of the insect. This practice prevailed in Europe for ages; and the amount of labor required for keeping the shelves clear of litter and filth, was nearly equal to the picking of the leaves. The invention of the hurdle has effected a vast reduction of toil in this branch of the business. It is a net work of strong cotton cord, with meshes an inch in diameter, spread on a light wooden frame three or four feet in size, which is large enough to contain a thousand worms. The wood cut delineates the hurdle lying upon the shelf. Place the hurdle with some leaves on it over the shelf of

worms, aud they will immediately crawl up and fasten on those leaves—now remove the hurdle till the shelf can be cleansed, then restore it to its place. Repeat this operation as often as necessary. In this way two men will keep a million of worms free of litter ; but without the hurdle, and according to the old system, it would require the best exertions of one hundred. The use of the hurdle is attended with another improvement of nearly as much consequence to the Silk culturist as the saving of labor effected by it. Those worms which do not immediately make their way to the fresh leaves on the upper hurdle when placed over them are diseased and defective, and must be thrown away, which will prevent the spreading of sickness among those which are healthy, and thin out all the inferior insects, so that every cocoon will be large, perfect, and valuable. The three first weeks the worm consumes but little food. Its Silk vessel begins to form at the commencement of the fourth age, when it will eat with much avidity, and must be fully supplied, or the quantity of Silk will be much diminished, and the quality greatly deteriorated. The worm usually lives six weeks, but the length of its life may be modified somewhat by circumstances. If well fed it comes to maturity sooner than when illy provided for. It is well to feed four or five times a day—but when the worm becomes inactive from cold, no food is required.

Leaves should not be gathered or fed to the worms when wet with dew or rain. A supply for two days or more should be kept in a cellar where they will not soon wilt, so that the worms may have dry leaves in stormy weather. When the worm is ready to spin its cocoon it changes its color, diminishes in size, and wanders in search of a place to make its ball. The spinning frames are made of narrow pieces of lath, nailed to two cross pieces at each end, three inches apart. This frame is placed over the hurdle, as seen in the wood cut, and also the ladder on which the worm ascends and winds its

ball. Here again a great labor-saving improvement has been introduced. Formerly bushes were set upright on the shelves on which the worms would fasten their cocoons; and the labor required to prepare and place the bushes, and to collect the silk was no inconsiderable item of the expense of producing the article. Nineteen-twentieths of this work is avoided by the introduction of the spinning frame above referred to. Those cocoons which are intended for market or for reeling should be steamed in a tight box for one hour, which will destroy the chrysalis. This should be done within six days from the time the cocoon was formed. If the moth is permitted to perforate the cocoon, it will nearly destroy its value. When there are a large number of cocoons, steaming is the most speedy and economical means of effecting the destruction of the chrysalis; but baking the balls in an oven slightly heated, or exposing them for a few hours to the rays of the sun, will kill the moth. The cocoons should be thoroughly dried after being steamed before they are stowed away. We shall speak more particularly on this subject hereafter. Before steaming, however, select the best and fairest cocoons for seed. It is a law of nature that the offspring shall inherit the diseases of the parent, and to this law, of course, the silkworm is not an exception. If diminutive cocoons are reserved for propagation, the miller will be feeble, lay bad eggs, and the worms prove sickly, and no subsequent care will ever repair the injury. We repeat, for it is of the utmost consequence, that the eggs must be good, or the worms will never prosper. Place the silk balls thus selected in a warm room, and spread them so that one shall not lie upon another, and within twelve or fourteen days the millers will make their way out of the cocoons, and must be removed and placed on cotton muslin, where within forty-eight hours the females will each deposit from four to five hundred eggs. The eggs and muslin should be carefully folded and kept together in glass jars, or tin

boxes, in a cellar until spring, when they should be put in an ice-house, that the eggs may not hatch until wanted.

There is no part of the labor pertaining to the business that is wearisome or disagreeable, but every stage of it is calculated to please, instruct, and charm. To the admirers of nature it unfolds one of the most interesting and curious operations in all its wonderful and infinitely diversified phenomena.

We append a few extracts from a "History of Silk Culture," translated from the Chinese, the oldest silk raisers in the world. They are useful for general knowledge, and are doubtless reliable :—

[*Translated from the Chinese.*]

The silkworms naturally love repose, and fear loud cries ; therefore their house should be quiet and exempt from all noise. They love the heat and fear the damp ; their apartments should therefore be constructed of boards. In a quiet and retired house they will not be troubled with the cries and clamor of men. In a close house they will be sheltered from the sudden south winds. In a house constructed with plank they will be sheltered from the exhalations and damp vapors of the earth.

WOU-PEN-SIN-CHOU.

The house of the silkworms ought to be distant from all impurities, and everything that exhales a disagreeable odor, such as stables, cows, etc. Care must be taken during the night that no light may penetrate the windows, or suddenly be shown in the dwelling of the silkworms. Do not extinguish in the silk-room paper matches, such as emit a great deal of smoke.

When the worms are newly hatched they fear the dust

made in sweeping. They are disturbed by crying and weeping; they do not like persons to come into their apartments who are not perfectly clean.

NONG-SANG-PI-KIOUE.

The art of raising silkworms begins with the choice of the eggs, and the preservation of the cocoons. Select in the cocoon room, the cocoons that are turned towards the light (that is to say, those from the top of the cocoon room), such as are brilliant, neat, and of a firm texture.

The moths which come out the first day, are called *miao-ngo* (viz: grass moths). The latest of all are called *mo-ngo*, (that is to say: the last butterflies). Neither of them ought to be kept. Only those which come out after the second day must be taken. The sheets of the paper must be spread upon the cases of a shelf, then the males and females come close together and copulate. When the evening comes, the male butterflies must be taken away, and the females must be placed on sheets of paper, leaving an equal distance between them. The eggs which are found in lumps ought to be thrown out. When the females have laid a number of eggs, they must be left on the sheets where they are deposited, and covered from three to five days. When the sheets are hung up, the eggs ought to be turned outward (read: in-ward) for fear the wind may cause them to perish.

The success in raising silkworms depends on the precaution which is taken in the beginning, and subsequently, not to expose them to any danger. If the silkworms do not revive *all at once*, from their first sleep, or moulting, it proceeds from their not having changed color, and not hatching *all at once*. If they do not change color, and do not hatch *all at once*, it is because the rules prescribed to preserve the eggs haue not been strictly followed.

Ho-pi-sse-loui.

When the silk worms lay down and remain motionless, that repose is called moulting. During the time of moulting they do not eat either the mulberry leaves or leaves of the tree, *tchè*. At the end of one day and night they shed their skins.

There are some silkworms which have three moultings, and others four.

What Hoang-sing-tseng Says.

"From the hatching of the silkworms to their third moulting cut leaves ought to be continually given them. When the ardent silkworms are fed, that is to say, Autumn silkworms, they must be carefully watched. As soon as they have eaten their leaves give them more, for they will fall sick if they breathe the heat of the silk-room fasting."

Manner of Feeding the Newly-Hatched Silkworms.

The leaves of the mulberry must be frequently cut in very fine shreds, and lightly spread over them with a sieve. The food ought to be distributed without interruption. In the space of one hour (two of our hours) four meals must be given them, which makes forty-eight repasts in the space of one day and night.

Food must be given to the silkworms without fail during the day and night. If their repasts are multiplied it will necessarily result that they will soon arrive at maturity; but if their meals are rare, and not numerous, they will attain their growth slowly.

When the silkworms attain maturity in twenty-five days, one frame or hurdle will furnish twenty-five ounces of silk. If in twenty-eight days, only twenty ounces can be obtained. If the time be one month, or forty days, one hurdle will furnish but ten ounces of silk.

Those persons who feed silkworms ought to endeavor not to sleep. Laziness has serious inconveniences.

Method of Diminishing the Food and Hastening the Moulting.

When the silkworms are disposed to sleep (to moult), their food must be diminished in proportion to the degree of yellow or white which their skin assumes; the leaves destined for their food must be cut in fine shreds, and frequently spread in light layers.

When the silkworms are completely yellow they ought to be transported in succession to other hurdles, without caring whether the sky be dark or serene, if it be in the morning or the middle of the night. When they have been transported to other hurdles the feeding must be suspended until they have all recovered from their moulting, when they may be fed again. This is called *diminishing the food* and *deciding the moulting*. Thest two expressions imply that the nourishing of the silkworms which are disposed to moult must be diminished (care must be taken not to cover or overload them with leaves), and on the other side the silkworms must be abundantly fed (which are not disposed to moult), in order that they may quickly moult. Not only will they *all moult together*, but they will be exempt from diseases caused by the accumulation of leaves, and the internal heat which consequently follows.

Nong-sang-thong-kioue.

The silkworms may be found in ten different situations : They may be cold or hot, starved or satiated, sufficiently far apart, or too near together, asleep or awake ; they may eat slowly or with appetite.

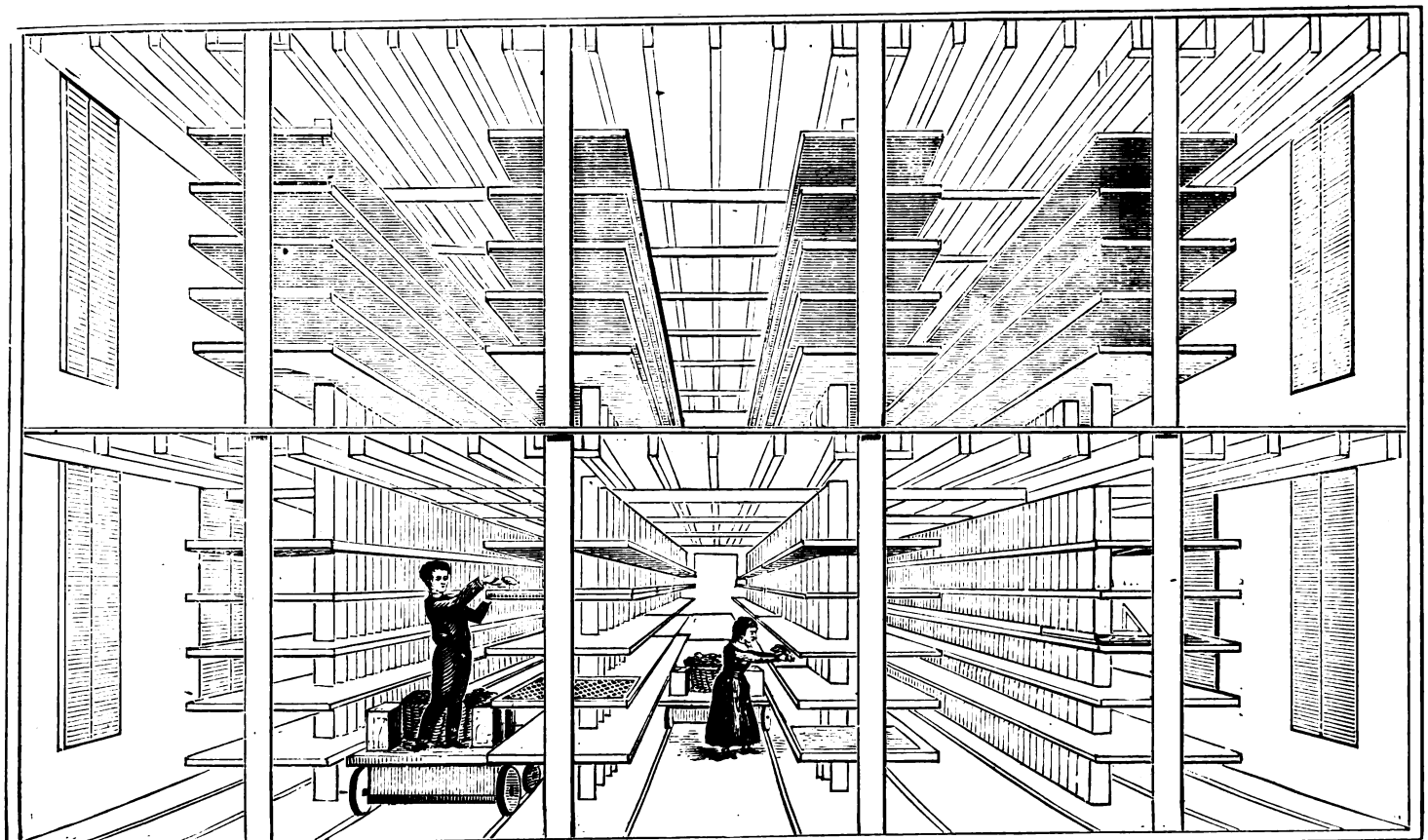
An Estimate of Silk Culture in 1840, from "The American Silk Culturist."

From an investigation, which I prosecuted last winter to some considerable extent, I ascertained that Silk could be manufactured and raised cheaper than cotton or flax. At least I satisfied myself on the subject. Children and aged people can perform most of the labor of procuring the raw Silk, which is the principal part. Let us make an estimate:

In one acre there are 43,560 square feet,
1,210 trees in one acre, 6 feet by 6,
4,840 " " " 1½ feet by 6,

Each tree, (Italian Mulberry, six years), will produce six pounds of leaves.
50 pounds of leaves, (some say 36), will feed 1000 worms
300 cocoons will weigh one pound.
3000 cocoons (10 pounds) make one pound of Silk.
30,000 trees, 6 years old, will produce 180,000 pounds of leaves, which will feed (at 45 pounds per thousand) four millions of worms. Allow 3000 to a pound of Silk; this, at $3 per pound, will amount to $3,999. Reeled Silk is, however, oftener valued at five or six dollars the pound than three.

The above calculation is made on the white Mulberry.



INTERIOR VIEW OF A COCOONERY.

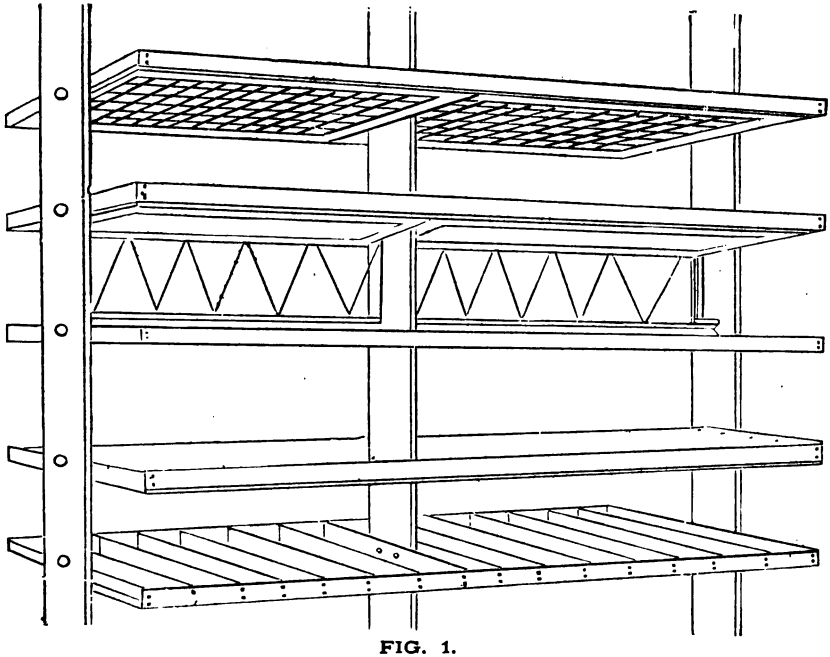


FIG. 1.

We here present our readers with an engraving representing an interior view of a cocoonery. The building is 100 feet in length, and 30 feet in width, and of two stories. The height of the lower story, which is the only one that we shall feed in the coming season, is nine feet, and contains, as will be seen by the plate (No. 1), four rows of feeding shelves, and five shelves in each row rising one above the other. They are cheaply constructed and will answer the purpose for which they were designed equally as well as more costly ones. Between each row is a railroad upon which is placed a car of a sufficient size to contain, on its platform, numerous baskets of leaves and the "*feeder*," and on each side of the platform is a step raised high enough to allow the feeder to supply the worms on the top shelf with leaves with the greatest facility. The object of the railroad and car is to economize labor and

do away the use of a ladder, for, by the present arrangement, the feeder can pull himself along as far at a time as is required, and can do more and better work than can possibly be done under the system generally practised.

The shelves are three feet in width and are made of 1-2 inch boards, the upper side smoothed, and are fourteen inches apart. The standards, which reach from the lower to the upper floor are placed at equal distanee from each other, four feet, and are one inch in thickness and six inches wide, and are in the centre of the shelves.

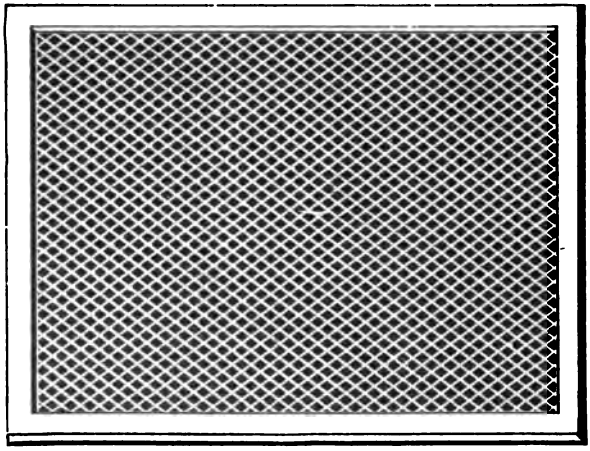


FIG. 2.

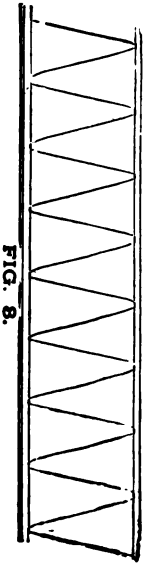


FIG. 3.

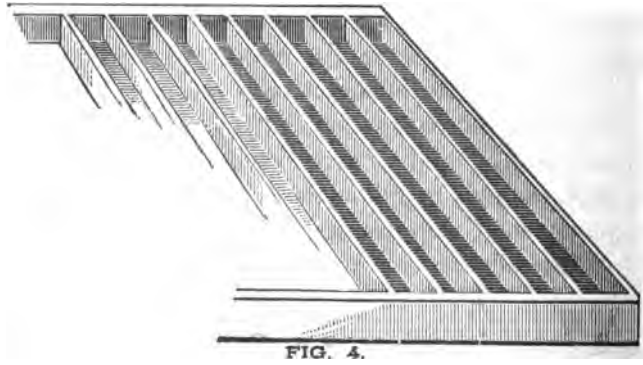


FIG. 4.

Plate No. 2, is the hurdle which is 3 feet 11 1-2 inches long, the frame being made of "inch stuff" and the meshes of the netting 3-4 of an inch square. The method of feeding the worm upon hurdles we consider most important. By the use of it the shelves are easily and quickly cleared without recourse being had to touching the worm with the fingers. When necessary to remove the litter from the shelves, it is readily done by placing a hurdle over the one in use, and strewing some fresh leaves over its surface. The worms (at least all that are healthy,) will immediately mount on the hurdle placed, and such worms as do not mount are thrown away with the litter, being considered as worthless. If the plan is adopted all the unhealthy worms will have been removed before the commencement of the 4th age, and consequently before the heaviest part of the expense will accrue in feeding. In the common method of feeding upon boards great quantities of filth accumulate, there is but little chance, if any, for a free circulation of air, and the worms are obliged to be moved separately by hand which, as is well known, is highly injurious to them.

Under the shelves and attached to them are thin pieces of rough lath 3 inches distant from each other, placed for the purpose of allowing the worm to form its cocoon with but little waste of silk, (see plate No. 4.) When the worms are ready to spin, a cheaply constructed ladder made of 1-2 inch sticks and wound around with Cotton cord, (see plate No. 3,) is placed above the hurdle in the manner shown by an engraving in the first number of this publication.

For the accommodation of those fed upon the top shelves laths must be raised between the joists overhead.

The light and current of air are graduated by means of stationary blinds, with moveable slats, which have been found to answer the purpose.

We are aware that there are almost as many minds in re-

gard to the construction of a cocoonery, as there are individuals, and that it would be a difficult matter to bring all Silk Growers to think alike upon the subject, and it will require more experience than is yet possessed by the American public, to bring the building, fixtures and management under the control of a proper system. Improvements are daily making, and as our countrymen have to compete with the laborer in Europe, whose pay for his work is merely nominal, it becomes us to adopt such plans as will be the most economical and judicious.

STIFLING THE COCOON OR CHRYSALIDE.

Were it convenient to reel the silk from the cocoon immemediately after it is spun, it would be the best possible mode; but where it is not convenient, the insect contained in the cocoon must be stifled within about ten days after the cocoon is completed, otherwise it will perforate the cocoon, which would thus be rendered of little value.

In many climates the power of the solar rays is found to be sufficient to destroy the chrysalide in the cocoon. This is an excellent mode, and is found effectual in India, in Italy, and in America. In 1838 as far north as Burlington, Vt., it has been tried by Mr. Stacy with the most perfect success. The cocoons are exposed fully to the scorching rays of the sun in a cloudless day from 10 o'clock in the morning till 4 in the afternoon, when they are to be closely wrapped in dark cloths which have undergone a like exposure to the sun's intense heat. Thus exposed during three days, to a degree of heat equal in the sun to 88°, their destruction becomes effectual, as may be ascertained on trial. Cut open a cocoon and prick the chrysalide with a needle; if living, it will then show signs of life. There may be no better mode, and cocoons thus managed, will appear remarkably bright and fine.

In more temperate climates, or in some parts of France, ovens are used for destroying the insect. The cocoons are placed in oblong, shallow baskets covered with paper, and over this a cloth, and these are placed in an oven, the heat of which should be *very nearly* that of the oven after the bread is drawn. Thus wrapped up and exposed during half an hour or an hour, the chrysalides taken from the centre of the basket will be found dead. On removal from the basket, they are covered closely with blankets for a few hours, and then dried in the sun. Steam of boiling water is a mode of destroying equally effectual. Boiling water is poured into a large wooden trough or vessel to the depth of two feet. Over this the cocoons are placed in a basket of the same form and size: this is covered close with woolen cloths, and the basket is lowered to within an inch of the surface, that the steam may pervade the whole mass—new quantities of boiling water being added to keep up the steam, in two hours the chrysalides will be found dead. The cocoons are then removed and covered close with woolen cloths, and afterwards spread in the sun to dry. 189° to 200° is the heat usually prescribed for killing the chrysalides, either in the oven or by steam.

Stifling by steam, observes M. Amans Carrier, injures the lustre, particularly of the white silk. And Monsieur Baumé, the celebrated chemist, has also remarked, that in the modes usually adopted for the destruction of the chrysalides, the cocoons were rendered harder, and more difficult to reel than where no artificial heat had been applied; and that the lustre is also injured in the process of *baking*. His mode consisted in placing the cocoons in large boxes, in layers six inches deep; on these spirits of wine were sprinkled from a watering pot, and equally distributed over the whole cocoons, in the proportion of half a pint to every superficial foot of surface. On these another layer six inches deep was placed, and a like proportion of spirits of wine distributed over the whole; and

so continuing till the box was filled. All being covered during 24 hours, a spontaneous heat ensues, which is sufficient to evaporate the spirit, which penetrates the cocoon with power to destroy the chrysalides; the cocoons are afterwards spread to dry, and are then ready for reeling, with no aid from hot water. M. Beaumé states that silk thus managed, not only exhibits a greater degree of lustre, but that the proportion of the silk reeled will be one ninth part greater than when the cocoons have been subjected to the heat of an oven.

By enclosing the cocoons in tin boxes, and, after sprinkling with spirits of wine, closing up the box and placing it in the sun, the chrysalides are in like manner speedily destroyed. Or, by closing them in a large wooden box, with a few small perforations in the top, and admitting at the bottom the steam of boiling whiskey or New England rum, the same effect is produced, Camphorated spirits are still more powerful and effectual. When these are used, the boxes containing the cocoons should be closed for a time, and placed near the fire; such cocoons are ever after secure from the attacks of moths.

The reeling should commence as soon as the first cocoons are completed, and should continue uninterrupted. These cocoons which become spotted in destroying the chrysalides, must be separated and reeled immediately.

By whatever process the chrysalides have been destroyed, it will be necessary to dry them thoroughly, either in the sun, or in rooms expressly appropriated to this use, which are called *cocoonieres*, and may be provided with a stove. These rooms are provided with shelves placed in tiers two feet asunder, and formed of laths. The legs of the supporters and the whole being insulated and secure from rats and mice, which are immoderately fond of the chrysalides. Air is continually admitted, and the cocoons which are spread to the depth of a few inches, are continually watched and turned every day, till dry.

TRANSPORTING COCOONS.

Cocoons when sent to market, or to the filatures at a distance for reeling, must be put up with a suitable degree of care. Particular attention is necessary in handling and packing, that they be not dented or flattened, as this would be highly injurious. The cocoons when perfectly dry, are to be packed in tight and perfectly dry boxes, or barrels, and sufficiently pressed down to prevent chafing, but not so hard as to alter their form. Thus managed they may be safely transported to any distance by water or by land. Pierced cocoons can be closely packed, without detriment to the cocoons.

REELING.

In silk countries, an establishment for reeling is called a filature, and the winding of the cocoons is generally conducted as a separate business, distinct from that of raising silk worms, and the silken balls become an article of traffic, as soon as the chrysalide within has been destroyed.

Everything, it is claimed, *depends on reeling*. So important, indeed, is this branch considered, that an essential portion of the profit depends on it being properly performed. If the reeling has been but indifferently performed, the silk may not sell for more than four dollars a pound, but if well reeled and skillfully executed, it may bring from six to seven dollars, possibly more, according to the demand at the time; and it is stated by Count Dandolo, as a well known fact, that of two reelers, each reeling seven and a half pounds of cocoons of the same quality, while one will be able to obtain but six or six and a half ounces, another will obtain eight ounces.

The filaments of the cocoon are cemented together by a gum; to dissolve this gum requires the aid of hot water. This

gum is very important, and is not separated till the silk is twisted into tram or organzine; the gum serves to unite and combine the individual fibres while winding, and as a cement uniting the ends of the continuous thread which is formed by the continual additions of new filaments to replace those of the exhausted cocoons. It is important also, that the reel should be moved with a suitable degree of speed, that the filament may unite while warm and adhesive. Also, it is an essential requisite to the production of good silk, that before the silk touches the bars of the reel, it should have lost by drying and by cooling, a good part of this adhesive quality. For this reason, the reelers of Piedmont are obliged by law to allow the distance of thirty-eight French inches between the guides and the centre of the reel. This, and the slowly-traversing movement of the layer which winds spirally over the reel, backwards and forwards, and the circulation of the air, caused by the motions of the reel, dries the gum sufficiently to prevent the adhesion of the threads.

Whoever would acquire the art of reeling silk, must first of all be provided with an appropriate and well constructed silk reel. Such an one may be either purchased or made at a trifling expense.

The use of the reel requires a dexterity which is easily acquired by practice. The cocoons being cleared of floss, are thrown by handfuls into basins of pure soft water, placed over small furnaces of charcoal fires. There is a certain kind of kerosene furnace which can also be used, but care must be observed not to soil the silk with smoke from the oil heater. The city gas can be used, but as this is not accessible in the country, any simple mode of hot water application can be made with water boiled on a stove, yet uniformity of heat must be kept up to facilitate the reeling of the cocoons. When the water is almost at boiling point, sink the cocoons, with a whisk of broom corn, under water for two or three

minutes, to soften the gum and loosen the fibre. Then moving the whisk very lightly and softly, the filaments will adhere to it, and may be drawn up till the flossy silk is unwound, and the fine silk comes off. When a sufficient number of the filaments are collected to form the thread, it is passed through one of the holes of the iron or glass plate connected with the guide and traversing bar, and tied to one of the bars of the reel, and the reeling begins.

If the cocoons bound upwards, out of the water, it shows that the gum is not sufficiently softened; the reel must be slacked, and hot water added, or its temperature increased: but if the silk comes off in lumps of burs, this shows that the silk is yielded from the cocoon faster than it can be received on the reel, and that the water is therefore too hot; cold water is added, and the motions of the reel are quickened.

Each reel carries two or four compound threads, and it has been recommended that the second thread be wound two or three times round the other thread, previous to being passed through its guide, and secured to the reel; this crossing and friction makes a rounder and smoother thread.

Stir the cocoons very lightly; if struck roughly, the silk comes off in burs, which will rise up to the guides, and obstruct the reel, instead of coming off singly. When a greater number of filaments are taken up by the whisk than are required, they are suffered to remain on it till wanted, a hook being provided on the reel to which it may be hung when not in use.

The cocoons are put in as fast as wanted, but no faster; for if they remain too long in hot water, the gum, by being too far dissolved, causes the silk to come off unequally.

The filaments as they are wanted, are lightly thrown upon the thread that is winding, and being gently rolled with the thumb and finger, a union is effected. The skin of the fingers should be smooth, or made so by rubbing with sand paper.

It is of some importance that the water employed for reeling, should be what is usually called soft water, as this more readily dissolves the gum, and prevents the breaking of the filaments. It should be either rain water, water from slow streams or from ponds.

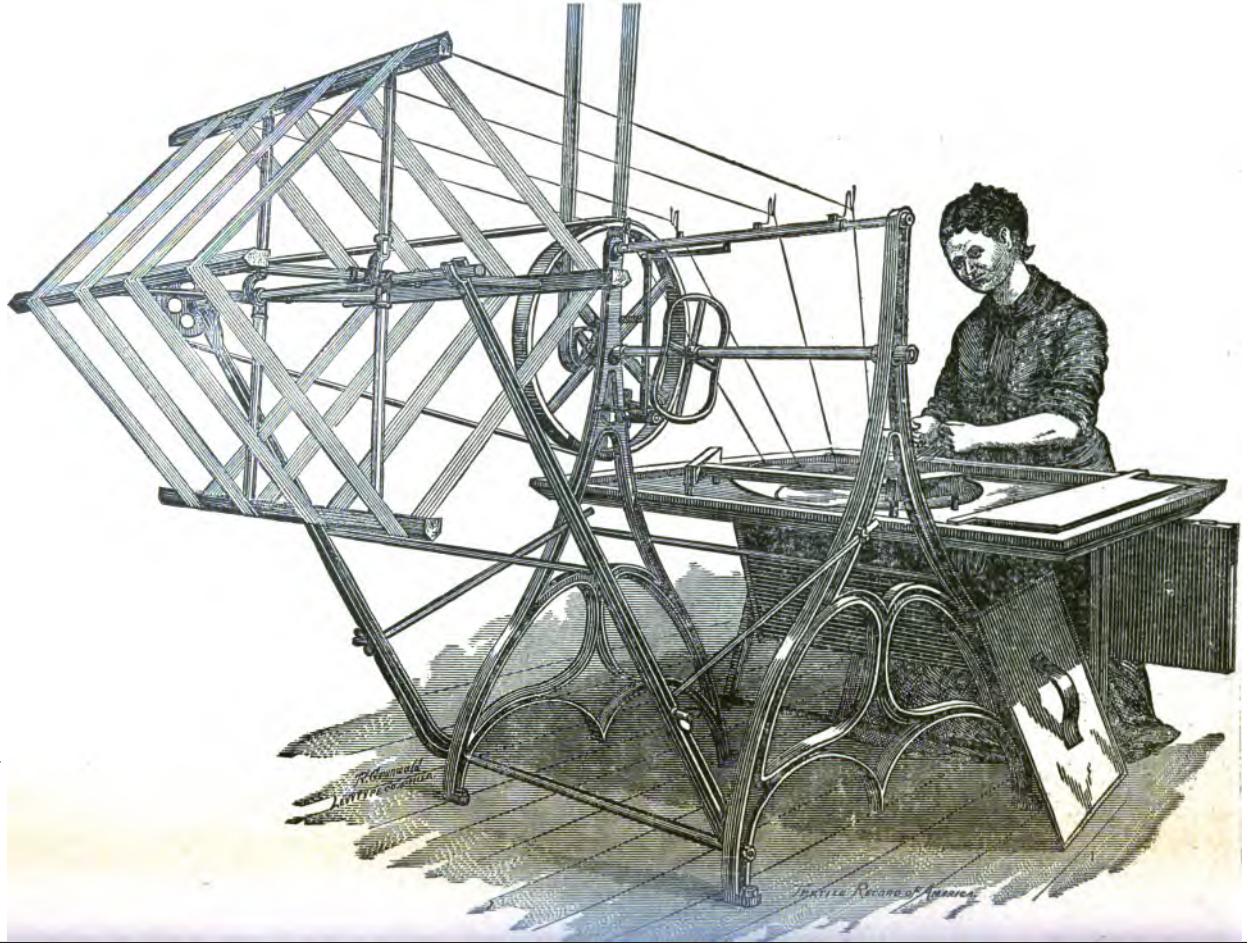
If the water be too hot, the lustre of the silk will be injured, particularly of the white silk; so says M. Benezech in his instructions to M. Amans Carrier. Nay more; if the water be too hot, the thread will prove *dead*, as it is technically termed, and without firmness. Therefore the proper temperature of the water is not of more consequence to the facility of the reeling, than to the good quality of the silk. But should the heat of the water be deficient, the ends of the filaments will not be well joined, and the silk will be harsh.

Sometimes the whole thread is broken, by knobs obstructing its passage through the guides, or by an irregular and jerking movement of the reel. But in this case the silk must never be joined by a knot, it is sufficient that the parts be brought together, and united by slightly twisting.

Silk may be wound of any size, but it is difficult to unite more than thirty filaments in one thread. The art consists in preserving as even thread; a thing only to be attained by practice, since in the same cocoon the fibres diminish, growing continually finer to the end; and the united thread which is formed of three new and two half-wound cocoons, is considered equal to the silk of four cocoons. With the exception of the silk formed of two cocoons, other silks are not distinguished, other than as silk of three to four, or four to five, or five to six cocoons. Those of larger size are not so nicely defined, and are called from twelve to fifteen, or from fifteen to twenty cocoons. The quality of silk thread most desirable in the silk market, is that composed of five cocoons, care being taken to keep it uniform, by adding new cocoons when one is exhausted.

Whether twenty cocoons are united to form one single thread, or whether the same number of filaments are employed in the production of four skeins, provided both are wound with an equally even thread, the amount of labor is about the same in both cases.

The weight of silk which can be reeled in any stated time, depends on the activity of the reeler: there is a degree of dexterity required in adding fresh ends, for broken or expended cocoons, which can only be acquired by *practice*. Yet there are very few reelers who are capable of giving the requisite attention to more than three or four skeins at the same moment of time.


Richmond
Textile Record of America

THE NEW SILK REEL.

The cut on opposite page represents a reel manufactured for the Women's Silk Culture Association. It is a beautiful piece of machinery, made of metal, and running smoothly, turned by hand. This can be done by a child of ten years.

This reel can be bought without the copper pan, for	$50 00
With the copper pan and copper table, tinned over,	65 00
With tin pan, copper bottom, and zinc table,	58 00
Extra reel or wheel,	12 00
The Association have now on exhibition a wooden reel, much less expensive than the above, and which does admirable work; which can be sold complete for*	20 00

Five cocoons makes the average commercial thread, and a good reeler can reel half a pound a day.

* This reel will be run at the Louisville (Ky.) Exposition, opening Sept. 5, 1882.

DIFFERENT QUALITIES OF COCOONS.

The cocoons designed for producing silk are divided by culturists into different qualities. Much more silk may thus be reeled in a day, if the cocoons are properly classed. The breaking of the single filaments arises from the use of ill formed or ill assorted cocoons, which require different degrees of temperature in the water into which they are immersed to dissolve the gum with which they are cemented in the ball.

Previous to reeling, the outer floss is separated. This is expeditiously performed by opening the floss at one end, when the hard, compact cocoon is readily protruded.

Cocoons are classed as follows:—

1. *Good Cocoons.* These are firm, free from spots, both ends round, and capable of resisting the pressure of the thumb and finger. These are again subdivided, and the pure white are separated from the yellow of every shade. These last are indebted for their greater weight and yellow color wholly to the excess of gum which they contain. Pale cocoons preserve a better and purer white, and take a better pale blue dye.

2. *Pointed Cocoons.* These approach to a point at one extremity: they afford but little silk, and, after being partly wound, the filament breaks continually at the point, where the thread is always weak, and they can be reeled no further.

3. *Cocalons.* These are larger in size than cocoons of the first quality, but contain no more silk, being less compact in their texture. These are separated in reeling from other good qualities, because they require immersion in colder water; the fibres being more easily disengaged from the gummy cement. By expert reeling, they produce silk of the first quality.

4. *Dupions* or *Double Cocoons.* These usually amount to not more than a hundredth part of the whole. These are

reeled by skilful reelers, in water boiling hot, and usually without difficulty. These being formed by the united labors of two silkworms, many of them are so intertwined that they break frequently in reeling, and sometimes they cannot be wound at all. The floss must be carefully separated, also any loose silk which may accumulate on the reel. The silk which these afford is not so fine as that of the perfect cocoon, but it serves to form sewing silk of the second quality.

5. *Soufflons.* These are very imperfect cocoons, the texture loose, even to a degree so great as to be transparent. These can never be wound, but by a particular process they are converted into *fleuret.**

6. *Perforated Cocoons.* These are the cocoons from whence the miller has escaped and are never reeled. Rev. Mr. Swayne was the first to discover that not a filament is broken but rather entangled. He has proved that half of them may be reeled. Yet it is doubtful whether it will ever be done to profit*.

7. *Good Choquettes.*—These are unfinished cocoons, or those in which the insect dies before the completion of their labor. On being shaken, the chrysalide is not heard to rattle, as it adheres to the side. The silk is as fine as that of the first quality, but it is not so strong nor so brilliant. They are liable to furze in winding, and must therefore be wound separately.

8. *Bad Choquettes.* These cocoons are defective or spotted: the silk which they afford is foul or bad, of a blackish color.

9. *Calcined Cocoons.* These cocoons are so highly esteemed, that in Piedmont they sell for half as much again as other good cocoons; but large parcels are rarely to be obtained.

* Macerated floss, made by removing the chrysalis and passing through hot potash baths, well rinsed in fresh water and dried; then passed through a macerating process, until all becomes a mass of soft silk floss, like fine wool. Machinery is the best agent, but it can also be done, when the quantity is not too large, by any individual.

In these, the silkworm, after having completed its labor, is seized with a peculiar disease, and becomes either petrified or reduced to a white powder. They are known by a peculiar rattling noise when shaken. The quality of the silk is equally excellent, and the quantity even greater than that produced by the healthy silkworms.

In reeling *good cocoons*, a thread composed of but *five* or six fibres, is said by M. Benezech to be preferred to one composed of *eight*. *Good choquettes* are seldom wound finer than from seven to eight cocoons at a time. *Dupions*, for ordinary sewing silk, are wound fifteen to twenty filaments to a single thread. *Bad choquettes* are usually wound from fifteen to twenty filaments to the thread. These, and other inferior cocoons, which are wound forty or fifty fibres at once, form a thread for the filling of coarse fabrics, or for sewing silk of coarser quality.

The water in which dupions and choquettes are wound, must be changed four times a day. But it is deemed sufficient that the water be renewed but twice a day, when good cocoons are reeled. Yet if the water is suffered to become foul, it injures the lustre and fine gloss of the silk.

In Cevennes, a district of France, famous for the excellence of its silk, the cocoons are not entirely wound off; as the latter part of the cocoon being exceedingly fine, and abounding with knots, is liable to break. Therefore, in reeling fine silk, when seven-eighths of the silk is wound off, the cocoon is thrown aside and replaced by another.

These pellicles are occassionally taken out with a ladle and opened, and the chrysalide separated and thrown aside with that which was separated in the beginning, as of inferior quality; for these partly finished cocoons must on no account be permitted to remain in the basins, as they would thicken the water, and injure the color and the lustre of the silk, rendering it fit only for receiving the dark colors.

As to the cocoons which can never be reeled, the soufflons are boiled half a hour; the pierced cocoons which produce the best silk, are boiled longer. These are first dried, and then pounded to separate them from their chrysalides, which are reduced to powder. They are then opened by drawing them out at arm's length, and placed on the distaff and spun. The silk thus produced is called fleuret. But if after boiling and drying, and beating, the cocoons are carded, the flouret will be more bright and beautiful, and command a higher price, owing to the greater waste of materials, and the far greater amount of labor.

In every large establishment there should be supernumerary reels, to be detached from the reeling apparatus. When the suitable quantity has been wound on the reel, it is to be rubbed gently with a handful of clean coarse silk which has been dipped first in cold water and gently squeezed; it is afterwards rubbed gently and smooth with the palm of the hand. Then opening the windows, turn the reel with the greatest possible velocity for about ten minutes, which will effectually dry the silk. This plan is resorted to only in large filatures.

Disbanding the Reel.

The individual fibres of which the silken thread is composed, will unavoidably suffer different degrees of tension during the process of reeling. This may arise from the inequality of the size of the filaments, or from their being unequally steeped in the water or from other causes. The fibres thus unequally stretched while wet, would be liable to contract, unequally, thus destroying the union and diminishing the strength of the compound thread.

To prevent such an occurrence, the skein must remain on the reel for six or eight hours, until the fibres are all firmly united in one compact thread. Those fibres which have suffered less strain in reeling, and those which have suffered

a greater strain, will be brought to an equal length by the prolonged and forcible state of union which they undergo in the process of drying and shrinking on the reel. This drying must be effected in an airy place, but not in the sun.

When the skein is dry, tie a mark to the end of the thread which might otherwise be lost in the skein, and become extremely difficult to find. First squeeze it together gently on the bars all around which will loosen it; then with a string of refuse silk, tie it on the place which bore on the bars of the reel; then carefully slide it from the reel and make another tie on the opposite end of the skein. After this it is doubled, and tied near each extremity, and laid by, for sale or for use, in a dry place.

The value of silk when ready for sale depends on the absence of knobs and of knots which occasion it to be called *foul.* To judge if silk be *clean,* or free from imperfections, is an art very easily attained. It is only necessary to stand with your back to the window, and to open the skein, and looking down in the direction of the light, any foulness which may exist, is readily perceived by the practised eye. But the fineness of the thread is determined by a certain known admeasurement of the circumference of the reel and skein, the number of threads, and the weight. A given number, usually a skein of 400 revolutions, is removed from the reel and accurately weighed.

PART V.

SYRIAN SILK CULTURE.

From the pen of J. Barton Hay, late Consul General in Syria.

EARLY in the month of February the leaves of the Lebanon Mulberry put forth, and the mites of silk worms issue by thousands from the eggs, and are immediately placed in small, round flat baskets covered with clay, where they are forthwith supplied with the tender leaves. Day by day the leaf increases in size, so the silk worms rapidly grow in proportion, till from almost being invisible mites, and then the size of ants, in the course of a week they attain to nearly half an inch in length, and have to be transferred to baskets double the size of the first ones. Meanwhile the peasant and his wife have had no sinecures. While the former has been busy in remedying what damages the *khooks* may have received during the winter, the latter aided by her children, has gathered at intervals the necessary supply of food for the worms; being careful first that the leaves should be *perfectly dry*, because one drop of dew amongst the leaves would be fatal to a whole basketful of worms. The *khooks* referred to, are long, narrow, slight structures of twigs and leaves intertwined, and supported at intervals by stout stems of old, useless mulberry trees; while the roofing is composed of thick layers of rushes, so plentiful in the marshy lands, which are impervious to rain; for, on the

one hand, whilst the worms must be effectually protected from rain or dews, on the other hand, they require a free circulation of air, a point which is attained by the net-work structure of the sides of the *khook*. The interior consists of a number of shelves on either side, which are made of a species of slit-reed mat-work, and rise one above another in tiers from three to four, according to the size of the *khook*, the lowest being at least two feet from the floor, and the uppermost about a foot from the roof. These shelves are called *batoors*, and according to their number is reckoned the wealth of the proprietor, and the quantity of silk they will produce; thus, in speaking of any particular mulberry plantation the natives, in bargaining, regulate the worth by saying: "Oh, it has only so many *batoors*, and can therefore only produce such a number of *rotolos* of silk; the *rotolo* being equivalent to five and a half pounds English.

To the *khooks*, after the expiration of two weeks or so, the worms are removed and spread upon the *batoors*, above alluded to, which have been carefully and thickly lined with mulberry leaves, to prevent the worms from falling through. Soon after this final transfer of the worm, begins that strange phenomenon of apparent utter lifelessness, which lasts for forty-eight hours, during which interval the creature is changing its first skin, having outgrown its India-rubber capacities. The natives call this the first *soame*, or fast. During the *soames* which are three in number, at intervals of about a fortnight each, the worms require no food. As they approach maturity, the appetite becomes prodigious, and early and late has the peasant to labor, lopping down huge branches of the mulberries, till what was a verdant and beautiful plantation becomes a wilderness of leafless branches. But so congenial is the climate and so fertile the soil, that in less than a month afterwards, fresh sprouts are covered with tender leaves, so that in autumn so thick is the foliage, so stout the branches, that the stranger

would never guess how recently they had been lopped. When the first leaves of winter fall, then are the trees again denuded of their foliage. This time, however, the branches are spared, and the leaves gathered by hand, and stored up against winter, when with the manure of the worms, they serve as fodder for the oxen, which would otherwise starve. The branches lopped off at first form a plentiful supply of firewood for the peasant's family.

The third or last *soame*, or fast, is the signal for the peasant to procure as much brushwood as he can, which, when dried in the sun, he throws lightly upon the *batoors*, or shelves. During this interval, the worms have become of a transparent golden color, and the moment they wake up again for the first time in their lives assume a migratory disposition. They select a fitting spot amongst the twigs for their cocoons. And now, whilst the little industrious worms are hard at work weaving, the peasants are not one whit less busy preparing for them a cruel death.

Huge wheels, which have been hidden for the last twelve months, are brought to light again and brushed up, the reservoir of water fresh lined with clay, and the whole apparatus set up against the first day of reeling, One peasant turns the wheel; another feeds it with the worms; another stirs up the worms being reeled with something like a schoolmaster's birch-rod; a fourth feeds the fire; a fifth supplies the basin with water as it becomes exhausted; a sixth renovates the basket with fresh cocoons; whilst near by, seated on a mat, are two or three occupied in picking the stuff from off the outside of the cocoons, and this material is known as cotton-silk or floss. They labor hard and long, but with good-will; during the first week after the cocoons are formed, since they obtain 30 per cent. more silk now than they will after that date, because then the cocoons have to be stifled to prevent the moths—into which they are rapidly being converted—boring through the

cocoons, and so rendering them utterly valueless and unavailable.*

The process of stifling is with the cocoon as simple as the process of reeling. Spread out upon mats, the cocoons are exposed to the fierce heat of the mid-day sun for a day or two, being carefully turned at intervals during the process, and this answers quite as well as the ovens so indispensable in less congenial climes where the silk worm is reared. After this process, the silk-reelers take it more easily. They know now that were they to work ever so hard, they cannot abstract one thread more of silk from the suffocated cocoons, and there is no fear of the moths boring their way through. Day by day the scene becomes more picturesque, as golden festoons of newly reeled silk are suspended from branch to branch to dry, and set off the beautiful foliage of the orange and lemon trees. By this method of reeling, they are supposed to obtain *one pound* of silk from *every five and a half pounds of live cocoons*, and just half that amount from those that have been stifled.

Of late years improvements have been made in the quantity and quality of Syrian silk, by the erection of European factories, and introduction of steam for motive power in them.

The cocoons left for seed, are perforated by the beautiful, short lived, white, velvety-looking moths, into which the silk-worm has been converted. The females deposit on linen spread for them, an incredible amount of eggs, which constitute the peasant's supply of seed for the next season.

When these are perfectly dry, they are carefully scraped off into a linen bag, and suspended from the ceiling of the peasant's hut, where they remain undisturbed for a twelve-month to come.

March, 1882.

*This plan is pursued when the reeling is done very hurriedly, or immediately after the cocoon is perfectly formed, and BEFORE it is STIFLED.

The following letter is from Mr. Werner Itschner, of Philadelphia, an extensive manufacturer of ribbon and silk goods, and who was one of the judges for the awarding of the Strawbridge & Clothier premiums; and at our solicitation he gives his views of the chief points to be observed in rearing good cocoons :—

PHILADELPHIA, *February 7, 1882.*

TO THE WOMEN'S SILK CULTURE ASSOCIATION.

Your request, that I should make a few remarks about the testing of the cocoons may be best answered, by the following statement:—

It is generally understood that the worms take a great deal of *room, attention, cleaning* and *feeding*. It will naturally be necessary to find the kind of cocoon that gives the most silk, *provided* the article obtained is of a good marketable quality, by which I mean than it has proper strength for working the thread, and good uniform color and lustre.

We, as judges, have therefore given the first three premiums to the cocoons of which the smallest number have given the largest amount of silk, and the very first premium we have awarded to the cocoons, amongst these three, which have at the same time given the strongest, cleanest, and most valuable silk for commerce, and we hope the producer of these cocoons has the chance of getting the seed again for himself and others, and I would also advise the ladies of the Association to publish for the benefit of the others, the observations which can be obtained from the producer of the best cocoons, because the good result may have not depended on the quality of the seed alone, but may have been owing to the way of feeding, and to other details in taking care of the worms.

Most of the silk obtained from the twenty-six lots of cocoons, I have found to be beautiful, but rather fine in size for reeling, say 25,500 yards to the ounce, which is hard to work

up. This *condition* arose from the *thread coming from too few cocoons in the reeling*—probably *three or four* instead of *five or six*. Five cocoons is considered in reeling to make the most desirable thread for commerce.

The cocoons to which the second premium is awarded come so very near to those of the first premium, that nothing more need be said of this lot except that the observations obtained from this producer may also be profitably used again.

The third premium was awarded to cocoons raised *partly* from *Osage orange leaves.** They are of small size, but have given a very extraordinary amount of good silk from the four ounces of cocoons reeled up, and this way of feeding is to be regarded of great consequence in this country where the Osage is so abundant.

I, however, would not encourage feeding *only* on Osage, because I doubt if the silk would be as good.

The other awards and honorable mentions were given to the next best cocoons, taking always into consideration the result in weight of silk, and the quality of the silk obtained, but I must say that, with the exception of only two or three lots, there was no *bad silk*.

There were some very *large cocoons* which contained almost *no silk*, which may have been the result of poor feeding. The necessity of feeding the worms with *as much* as they can eat, which alone gives *them power* to produce silk, may in these cases, not have been well enough known.

It is not *enough* to keep the worms *only alive*.

It is easy to see that it must be more profitable to get one-and-a-half ounces of silk out of 150 cocoons, than to get the same amount of silk out of 300 cocoons, or even only one ounce of silk out of 350 cocons, of which we had some cases. This can be done only by employing *first good seed*, second by

* This same gentleman wove for the Association, twenty yards of scarlet ribbon from six and a half ounces of Osage orange cocoons, having from this amount 5/6 oz. waste.

great attention to the *comfort of the worm*, and by giving him *all the leaves* he can eat, *because* the worm is *short lived*, and must make a *very long thread* out of the food furnished to him.

If he only gets *enough to live on* he will only leave behind him *an empty shell*, in place of a *cocoon full of silk*.

The test which was made by taking one quarter of each pound of cocoons, and having this quarter pound reeled—counting the cocoons—giving very carefully the amount of silk obtained is a *very excellent one*. Another year it would be still further improved by having these skeins reeled off and made into yarn, and having them dyed all into one uniform color, and have premiums awarded to those that prove the best in all the processes. All this can be done here in Philadelphia. Respectfully,

WERNER ITSCHNER,

The thanks of the Association are due to Mr. Itschner for this valuable letter, which puts in a plain, business-like manner, a few facts useful to silk culturists, and shows the need of careful attention to the prominent points of good seed, cleanliness and free feeding, with the right kind of food, which is mulberry. Osage orange will do for experiments, may entirely do for silk of commerce, but when food must be planted we urge the mulberry.

Letter from one of the Ladies who received a Premium at the Silk Exhibit of 1882.

Camden, *February 20, 1882.*

To the Women's Silk Culture Association of the United States, in Philadelphia.

Agreeable to your request and my promise, I will give you a few items from my observation of many years experience in raising silk worms. First. I base the *quantity* and *quality* of silk produced upon the *quantity* and *quality* of food from the hatching to the spinning. The selection of the best tender leaves during the first ten days or till after the second moult, is of great importance; even though it may be when the tree first puts forth its leaves, there is a choice of leaves for the infant worms. After the second moult, the worms are able to eat leaves a little thicker and each day shows their ability for stronger food. After the last moult, use the thickest and best leaves the tree produces. If the leaves are very thick, and in picking show a rich, milky juice, they are the very best for the last week's feeding for quality and quantity of silk. From the hatching to the spinning give them all they can eat, feeding them early in the morning and through the day as often as they consume the food, and as late as ten o'clock evening, observing the days of moulting when they require little, as directed in C. V. Riley's book, at the Agricultural Department at Washington.

Never use wet leaves, if the leaves are dusty they should be wiped with a soft cloth. Wilted leaves will not produce much silk. I usually gather leaves for the day in the morning, while they are cool from the night atmosphere and find them to keep fresh in the cellar through the day; at sunset gather for the morning feed, never had any inconvenience from dew, (perhaps low, bushy trees might have dew on them.) Morning and

evening is the most available time to have farm-help to assist in gathering leaves, and we always practiced this way with a good result. Temperature for worms requires attention, and a thermometer is the standard test and a regulator for persons inexperienced. Temperature as noted in C. V. Riley's book, probably is correct. I think if carried out fully, would be practical. (I have never used a thermometer for this purpose.)

Worms need air in the room, but avoid a draft on them, especially when small.

For convenience I have found it a good way to place the worms just hatched in open paper boxes, about two inches high, this rather protects them from a draft of air; they may be kept till two weeks old in this way in the sitting-room, where they will be little trouble and pretty sure to have attention. To keep each day's hatching separate is well suggested by C. V. Riley . . . Choking cocoons. The steam process I have not tested; should think it good.

I put mine in paper boxes, about three layers of cocoons, and set them in the oven on slats of wood, the slats prevent the heat from scorching the cocoons; watching carefully not to have them overheated from the top, in fifteen or twenty minutes removed them, as all sound and motion ceased and life extinct, then spread them in a room for the dead chrysalis to dry, great care that ants do not get to them as they will pierce the cocoon.

If the cocoon remains a long time in an oven, the silk dries together and does not reel freely. This method requires thought and judgment as to the heat and time to destroy life, and no positive rule can be given. While by steaming it may be easier to follow a prescribed direction. Forty years ago it was the practice to reel as soon as the cocoons were completed. Reason given; they reel more freely before they dry. But, if any had to be choked it was done by putting them in the sun, in tin pans, upon a scaffold against the south side of a

building, where they received great concentrated heat from nine o'clock A. M. till three P. M., and this generally was sufficient. Of course, they were spread thin and stirred occasionally and a still day, was desirable.

Reproduction of eggs. We always select the firmest, best color, finest looking silk, and every way the best cocoons.

Yours Respectfully,

MRS. H. M. BUTTON.

CAMDEN, *March 1882.*

CONCLUSION.

In closing this revised edition of the Book of Instruction in Silk Culture, we appeal to the public for their kind consideration in behalf of its imperfections. Our desire has been to give various, plain, simple processes for the use of the people, unvarnished by sentimentalisms and technicalities, or complicated by foreign expressions and botanical terms, so frequently occurring in the books of instruction copied from foreign authors. We hope it may convey the plain, simple facts, required to give aid to intelligent minds, and to help the simple folk into intelligent comprehension of what they must do, to carry on successfully this most interesting and instructive home industry. We desire to guard the people against any false statements, of profit and gain, as well as against the fallacy of silk culture as a *city industry*. Reeling silk may eventually become *so*, yet it is desirable that reeling shall constitute the winter work of this home industry in the country. True, it is urged, that reeling should be done, while the cocoons are *fresh*, (immediately after the cocoons are formed), and thus avoid the process of choking or killing the chrysalis; this can be done, when hurredly packed and sent to the steam filature, or reeling mills, but as no such establishments exist as yet in our country, we recommend the home reeling. From the agent of the largest Chinese silk house, in New York, we have been assured, that hand-reeled silk is preferred for the highest grades of manufacture. *Time* will be required to perfect *this part* of the industry, as in every new undertaking of an industrial character. Patience will be needed, but

we earnestly urge silk reeling at home. We would invite agricultural schools to teach a process of silk reeling, that the young may learn this delicate, but easily taught branch of silk culture. It could hardly be expected that a few women, even if bent on a benevolent project, could attempt to teach silk reeling throughout the States. It would require much outlay in the Association, and expenditure by those living at a distance in travelling expenses; the true place to propagate this branch of the industry, is in our technical and agricultural schools and colleges. We are supported (and illy) by voluntary contributions, have feeble means, but have demonstrated the facts of the case fully—have put before the public a simple reel—which, can be ordered through the Association, either of metal or wood, at prices within the reach of families.

The Metal reel is a neat, attractive piece of machinery, as per illustration on page 122, and can be sold for—

Plain Reel, without pan, ...	$50 00
" " with copper pan and table, . . .	65 00
" " " tin pan and table, ...	58 00
Extra wheel or reel, ...	12 00

The wooden reel is less complicated, reels just as good silk, (would probably not be quite as durable in wear and tear) but effectual for all the purposes of reeling the best commercial silk. Can be sold for $20.00. Orders will be received through the Association at 1328 Chestnut Street, Philadelphia.

In closing these few remarks, we earnestly urge the intelligent portion of residents in small country towns to aid in domesticating silk culture throughout their neighborhood among their poorer classes, small agriculturalists especially; not to be discouraged if first experiments are not entirely successful, time and experience are needed to the perfection of any work. Sericulture has been for centuries an industry of the old world, but, during the last thirty years, it has been in decadence

owing to the prevalence of disease among the silk worms, and in the face of this fact, added to a growing demand among all the peoples of the world, and a home market consuming upwards of $15,000,000 worth of raw silk annually, increasing at a ratio of 2,000,000 per year, I heartily recommend this industry to the teeming thousands of our own land. With an emigration to our shores which the fiscal year up to June, 1882, foots up at 800,000, it behooves us to plant new agricultural industries, that these crowds of new comers may develop our vast plains into fertile farms, and not crowd our teeming cities to the dangers of a surplus of consumers with a deficit of creators. With best wishes for the success of Sericulture as a home industry among the women and children of our vast country, and a hope that ere long, the thousands of humming looms of our country will weave nought but the golden threads raised by our own people, dividing among them the treasure now carried to other lands, I am your earnest coworker and friend.

MRS. JOHN LUCAS,

President of the Women's Silk Culture Association of the United States, Office, 1328 Chestnut Street, Philadelphia.

June, 1882.

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